# CITY OF HUGHSON

## Climate Action Plan

Prepared for
City of Hughson

Adopted December 9, 2013
City Council Resolution #2013-35

ESA

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# Overview

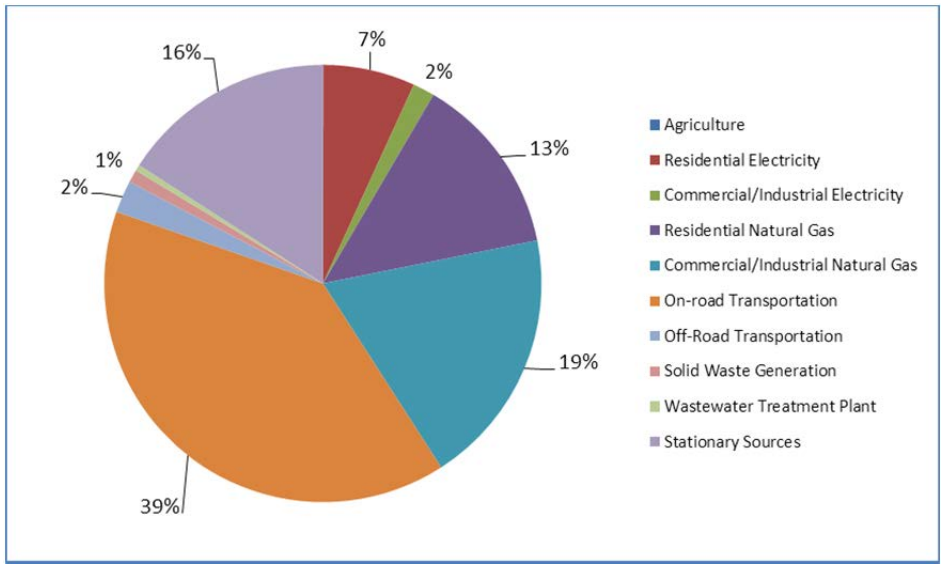
Given the scientific consensus that greenhouse gas (GHG) emissions caused by humans are a major contributor to global climate change, the State passed the Global Warming Solutions Act of 2006 (AB32). AB 32 directs the State to reduce state-wide GHG emission to 1990 levels by 2020. In response, the City of Hughson, like many other jurisdictions in the State, is addressing climate change at the local level by preparing a Climate Action Plan (CAP). One of the primary goals of the Hughson Climate Action Plan is to identify strategies to reduce the contribution of the community and municipal operations to GHG emissions. By using energy more efficiently, enhancing access to other modes of transportation, recycling waste, and conserving water, Hughson will be able to keep more dollars within the local economy, create new green jobs, as well as improve public health and the quality of life.

# Measuring Our Emissions

The first step in completing the CAP was to refine Hughson's GHG inventory for the baseline year of 2005, which estimates the total amount of GHG emissions generated by the community and through municipal operations. The community GHG inventory is based on all emissions generated by the community within the jurisdictional boundaries of Hughson. The baseline 2005 GHG Inventory for the City of Hughson totals 32,643 metric tons (MT) of carbon dioxide equivalents (CO2e) generated by the community, broken down by sectors below:

Figure ES-1

2005 Community Emissions by Sector

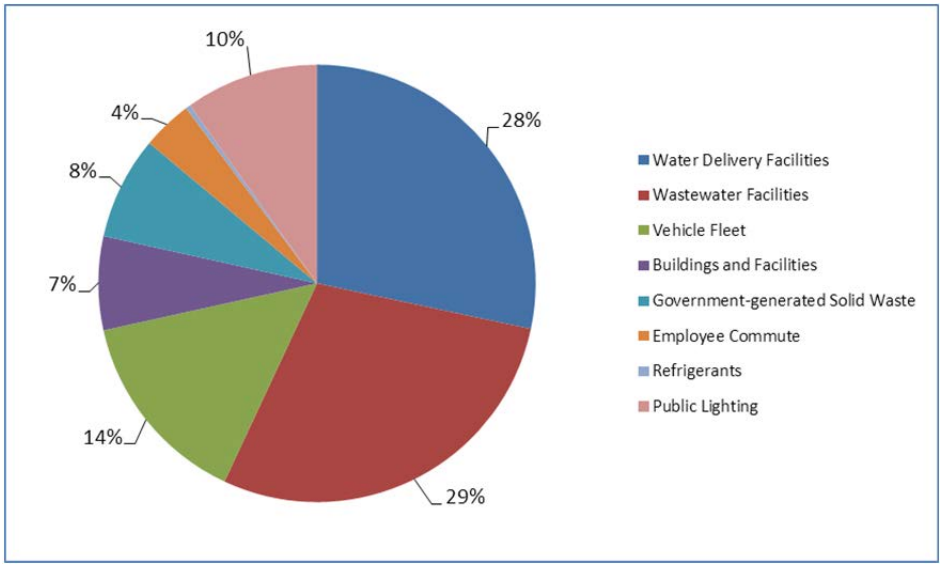



SOURCE: ICF, 2012

A municipal GHG inventory identifies the sources and quantities of emissions generated by local government operations, which were approximately 1,270 MT CO2e in 2005. This represents approximately 3.9% of the total community-wide inventory.

Figure ES-2

2005 Municipal Emissions by Sector




SOURCE: ICLEI, 2011

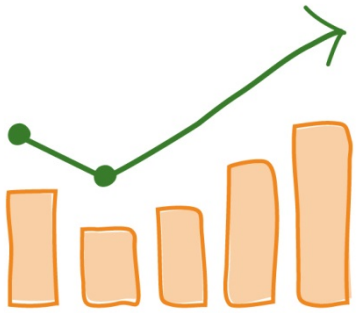
If the City of Hughson does not take any action to reduce its GHG emissions, then our contributions to climate change would continue to grow, potentially resulting in greater impacts associated with increases in temperatures, decreased precipitation, less water supply, and reduced agricultural productivity. This is shown as the "business-as-usual" (BAU) condition, which is part of the GHG inventory. BAU emissions are

described as emissions that would be generated in the absence of strategies designed to reduce emissions over time. Under the BAU conditions, Hughson's GHG emissions would increase to 35,901 CO2E MT in 2020.

# Reducing Our Emissions

In order to do its part in reducing GHG emissions in the future, the City of Hughson has a target of reducing greenhouse gas (GHG) emissions to 1990 levels by 2020 consistent with State mandates (AB32).

*2020 Reduction Target: 15% below 2005 levels*



# Taking Action

The Hughson Climate Action Plan includes a series of goals, strategies, and actions to be implemented by the City to reduce GHG emissions and meet its climate change goals. In order for the City to be successful, the community and businesses of Hughson will also need to participate in implementation of the CAP. As a result, there will be net benefits for everyone – lower energy bills for residents, lower operating costs for businesses, a strengthened economy and greater quality of life for the community.

The CAP contains 13 goals that are organized into four primary sectors, as follows:

## Energy

Goal E.1: Increase Building and Equipment Efficiency Community-Wide

Goal E.2: Increase Renewable Energy Generation and Use Community-Wide

Goal E.3: Increase Energy Efficiency and Renewable Energy Generation and Use in Municipal Operations

## Transportation and Land Use

Goal T.1: Reduce Single-Occupancy Vehicle Travel

Goal T.2: Increase Non-Motorized Travel

Goal T.3: Improve Public Transit Use

Goal T.4: Increase Motor Vehicle Efficiency

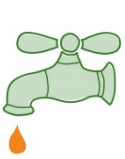
Goal LU.1: Promote Sustainable Growth Patterns

Goal LU.2: Support Locally-Produced Foods

## Solid Waste Management

Goal SW.1: Reduce Per Capita Community Solid Waste Sent to Landfill

Goal SW.2: Reduce Per Capita Municipal Operations Solid Waste to Landfill



## Water Conservation

Goal W.1: Increase Community Water Conservation

Goal W.2: Reduce Municipal Operations Water Consumption

# 1 Introduction

## Overview

Given the scientific consensus that anthropogenic or "man-made" greenhouse gas (GHG) emissions are causing global climate change, the City of Hughson is joining an increasing number of California local governments committed to addressing climate change at the local level. The City recognizes the risk that climate change poses to its residents, business owners, and visitors, and is acting now to reduce the GHG emissions from both its government operations and the community at-large through the strategies set forth in this Climate Action Plan. Although state and regional policies and programs are being implemented to reduce GHG emissions, ultimately local action is needed to ensure that Hughson is doing its part to mitigate climate change and adapt to its current and future effects. This Climate Action Plan (CAP) takes a common sense approach to reducing GHG emissions in the City of Hughson, with policies and cost-effective programs that the City itself, as well as its residents and businesses, can implement to reduce energy consumption, the amount of vehicle miles travelled, water use, and waste sent to local landfills.

## Purpose and Scope

This Climate Action Plan outlines strategies, goals, and actions for the City and its community to reduce municipal and community-wide GHG emissions. It is designed to ensure that Hughson does its part to meet the mandates of California's Global Warming Solutions Act of 2006 (AB 32), while taking into account the Hughson General Plan vision for future growth.

AB 32 directs the state to reduce state-wide GHG emissions to 1990 levels by 2020. To achieve these reductions, the California Air Resources Board (CARB) and the State Office of Planning and Research (OPR) recommend that local governments target their 2020 emissions to be 15 percent below 2005 levels, deemed to be equivalent to 1990 emissions levels.

The baseline 2005 Community GHG Emissions Inventory for Hughson includes 32,643 metric tons of CO2 equivalents (MT CO2e). Emissions from municipal operations, included in the community inventory, were 1,270 MT CO2e in 2005. Under business-as-usual (BAU) conditions, community GHG emissions are

forecasted to be 34,232 MT CO2e by the year 2020. To be consistent with the AB 32 goal, the City must reduce its annual emissions to approximately 27,747 MT CO2e by the year 2020. This is a reduction of 19% (6,485 MT CO2e) from the 2020 BAU forecast.

Several initiatives at the state level will help the City reduce GHG emissions, but they alone will not be sufficient to meet the 2020 target. Primarily due to their control over land use and building practices, local governments play a key role in reducing GHG emissions. This Climate Action Plan provides a roadmap for the City to be proactive in reducing GHGs through a series of local actions, so that the City can help mitigate climate change while doing its part to meet the requirements of state law. In addition, efforts to reduce GHG emissions generally provide co-benefits to improving public health, increasing economic development, including providing local job opportunities, reducing energy bills, improving air quality, and enhancing quality of life.

The City of Hughson conducted an analysis of and considered many potential GHG-reduction strategies and actions. Best-suited measures were chosen primarily based on their ability to reduce GHG and cost-benefit characteristics, with additional considerations for funding availability and feasibility of implementation. The selected measures are included in this Climate Action Plan and address transportation and land use, energy consumption and generation, water use and wastewater treatment, solid waste disposal, and municipal operations. For each emissions sector, the Climate Action Plan presents goals, strategies, and specific actions for reducing emissions, along with quantified cost-benefit impacts where possible. An implementation and monitoring plan is also provided. The initial implementation timeframe will begin in 2013 and span past 2016.

# Relationship to Other City Plans

This Climate Action Plan, in presenting measures for reducing community GHG emissions and increasing resilience to climate change, is closely aligned with the goals and policies outlined in the Hughson General Plan (adopted in 2005), as well as other City policies related to sustainability. The CAP is a “stand alone” policy document, and will help the City meet its long-term planning goals.

The strategies presented in Chapter 4 of this Climate Action Plan are consistent with the goals and strategies included in the Hughson General Plan. Implementation of the General Plan goals and policies will reduce Hughson’s carbon footprint by: increasing building densities; developing a balanced land use pattern; incorporating a mix of residential types; developing a connected street pattern that serves a variety of transportation modes; reducing parking standards in downtown Hughson; supporting public transit service; providing a safe and convenient bicycle and pedestrian network; improving water quality; preserving agricultural resources and open space; and reducing solid waste reduction. In addition, the City has now committed to keeping future growth within the Urban Growth Boundary. Therefore, all development will be limited to the Sphere of Influence until the year 2050.

# Document Content

The Climate Action Plan is organized into the following chapters, as described below:

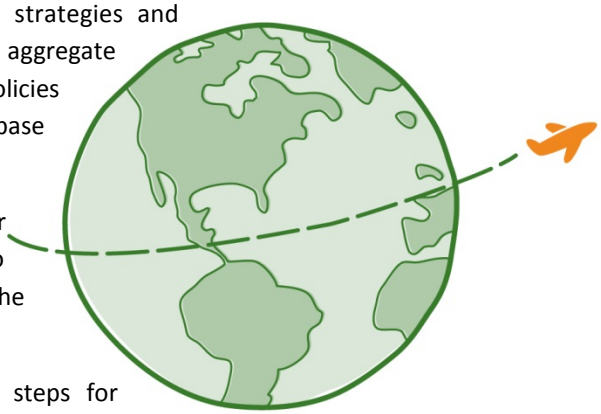
**Executive Summary.** This section provides a summary of the Hughson Climate Action Plan.

**Chapter 1: Introduction.** This chapter provides an overview of the document, the purpose and scope of the Climate Action Plan, and its relationship the Hughson General Plan.

**Chapter 2: Climate Change Background and Regulatory Setting.** This chapter presents the basic science behind climate change and the ongoing research related to its effects on the natural and human world. In addition, Chapter 2 provides a brief explanation of federal regulations, state actions, and local actions pursuant to state requirements to reduce GHG emissions.

**Chapter 3: Greenhouse Gas Emissions Inventory, Forecasts, and Targets.** This chapter presents the community-wide inventory of GHG emissions for the 2005 base year. A subset of those emissions—municipal emissions attributable to government operations—are also presented. Using projections of population, employment, and new residential and commercial development, future emissions for the year 2020 are estimated for BAU market-based conditions. In addition, future year emissions for the year 2030 are estimated for BAU General Plan build-out conditions. This chapter also estimates the cumulative effect of implementing state-wide measures in reducing GHG emissions over time. Finally, this chapter establishes the 2020 GHG emissions target as 15 percent below base year 2005 emissions, and describes the emissions "gap" that the City of Hughson Climate Action Plan must close to reach that target.

**Chapter 4: Reduction Goals, Strategies, and Actions.** Reducing emissions to at least 15 percent below the 2005 base year inventory will require the City of Hughson and its residents and businesses to commit to strategies that impact energy use, development density and vehicular use, solid waste diversion, and water consumption. Chapter 4 addresses each of these major categories, summarizing the category's contribution to total city-wide emissions and describing the strategies and measures that will be implemented to reduce emissions from each category over time. It also provides estimates of the emissions reduction potential for individual strategies and actions in each category in 2020, as well as a summary of the aggregate impact of all strategies in 2030. Chapter 4 also incorporates the policies and programs that Hughson has implemented since the 2005 base year, accounting for their emissions reduction impacts.



**Chapter 5: Preparing Hughson for Climate Change.** This chapter presents an overview of the impacts Hughson is expected to experience due to projected changes in the climate, and what the City can do to begin preparing for them.

**Chapter 6: Monitoring.** This chapter outlines recommended steps for implementing the CAP strategies described in Chapter 4, and for monitoring the progress of implementation.

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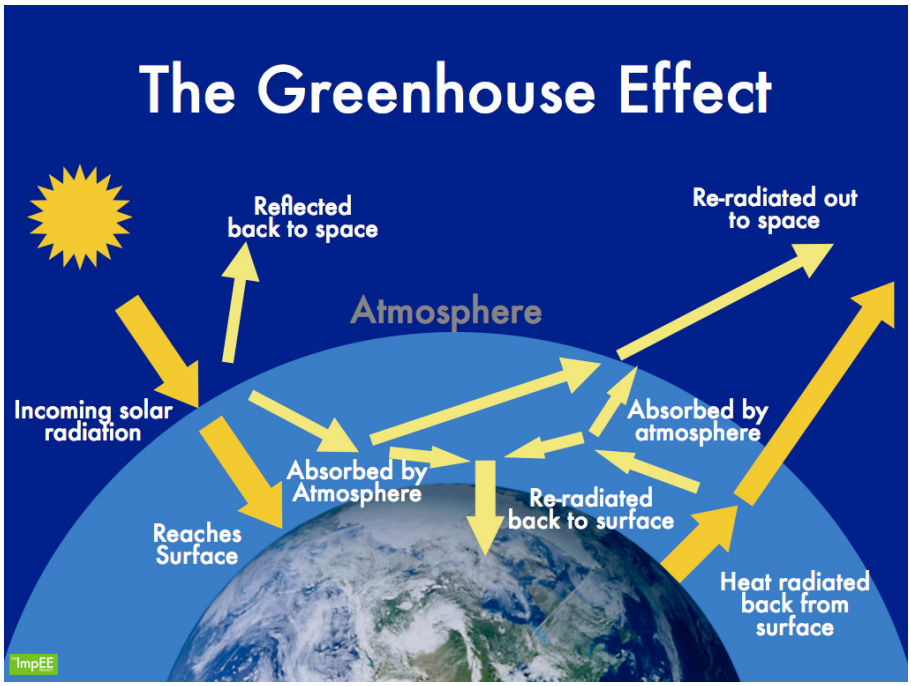
# 2 Climate Change Background and Regulatory Setting

## What is Climate Change?

Climate change is described as a significant and lasting change in the planet's weather patterns over a long time period. The scientific community has reached consensus that climate change is occurring at a global scale, and climate change is a widely discussed economic and political issue in California, the United States, and internationally. According to the Intergovernmental Panel on Climate Change (IPCC), "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level."[1] Regional changes in climate, particularly temperature increases and changing precipitation patterns, are already affecting natural systems worldwide, and will have widespread impacts on water availability, food production, ecosystem biodiversity, and human health. These changes can result in significant impacts to the health, economy and environment of the Hughson community and beyond.

GHG are gases that trap heat in the atmosphere and regulate the Earth's temperature. This effect, known as the Greenhouse Effect, is responsible for maintaining a habitable climate, as shown in **Figure 2-1**. Climate change is occurring because of the ever-rising rate of emissions of warming-inducing gases into the atmosphere, According to the IPCC, it is very likely that human-generated GHG emissions, which have increased considerably since the mid-20th century, are a primary cause of climate change. Since the dawn of the Industrial Revolution around 1750, human activities have increased atmospheric concentrations of GHG emissions, levels of which now far exceed the average atmospheric concentrations of the past several thousand years. Land use changes, burning of fossil fuels, and agricultural practices have all contributed to this observed increase. Global climate models clearly show that human activity is having an effect on global temperatures.

Figure 2-1
The Greenhouse Effect




SOURCE: (University of Cambridge, 2006)[2]

The most prevalent GHGs are carbon dioxide (CO2) and water vapor. Others important GHGs are methane (CH4), nitrous oxide (N2O), chlorofluorocarbons (CFCs), hydroflurocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). These gases are emitted through a variety of natural processes and human activities, as follows:

- Carbon dioxide and nitrous oxide are byproducts of fossil fuel combustion;
- Nitrous oxide is associated with agricultural operations, such as fertilization of crops;
- Methane is commonly created by off-gassing from agricultural practices (e.g., keeping livestock), anaerobic composting, and landfills;
- Chlorofluorocarbons were widely used as refrigerants, propellants, and cleaning solvents, but their production has been mostly eliminated by international treaty;
- Hydrofluorocarbons are now used as a substitute for chlorofluorocarbons in refrigeration and cooling; and
- Perfluorocarbons and sulfur hexafluoride emissions are common byproducts of industries such as aluminum production and semi-conductor manufacturing.

Global Warming Potential (GWP) is a quantitative measurement that expresses the relative warming potency of each GHG. Carbon dioxide is assigned a GWP value of 1. Sulfur hexafluoride is several orders of magnitude stronger with a GWP of 22,800. For GHG emission inventories, the weight of each gas is multiplied by its GWP and presented in units of carbon dioxide equivalents (CO2e). **Table 2-1** lists the six primary GHGs (also known as the Kyoto GHGs), their chemical formula, the lifetime of the compound, and their GWPs relative to CO2.

Though CO2 has a lower GWP than other GHGs in the atmosphere, it is the largest contributor to anthropogenic warming over the last century because of the sheer volume of human-induced CO2 emissions over that time.

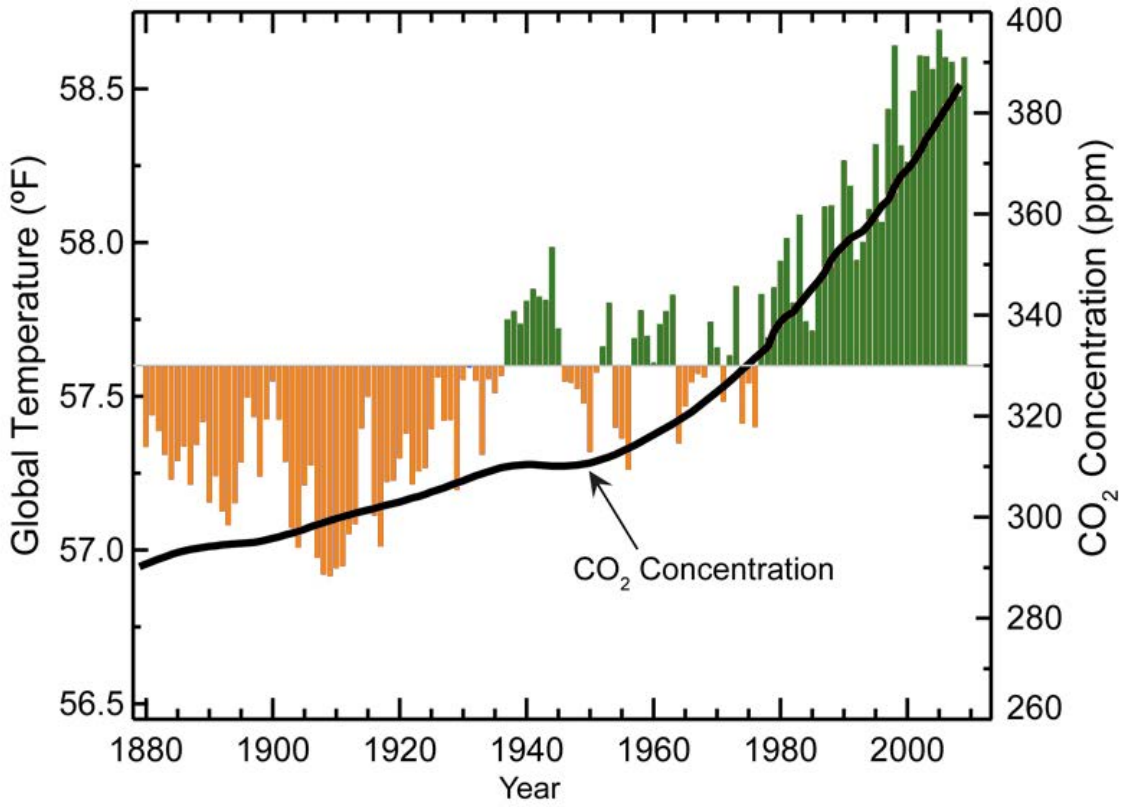
**Figure 2-2** shows the strong correlation between atmospheric CO2 levels and observed global temperatures over the past 130 years. Concentrations have risen most rapidly since 1980, closely tracking the steep rise in temperature.

Table 2-1
Greenhouse Gases Covered by the Kyoto Protocol
(Lifetime and Global Warming Potentials from IPCC1)

| GHG | Chemical Formula | Lifetime (years) | Global Warming Potential for 100-year horizon |
|---|---|---|---|
| Carbon Dioxide | $CO_2$ | 1 | 1 |
| Methane | $CH_4$ | 12 | 25 |
| Nitrous Oxide | $N_20$ | 114 | 298 |
| Sulfur Hexafluoride | $SF_6$ | 3,200 | 22,800 |
| Hydrofluorocarbons | HFCs | 1.4–270 | 77–14,400 |
| Perfluorocarbons | PFCs | 1,000–50,000 | 7,390–22,800 |

1 IPCC Fourth Assessment Report: Climate Change 2007 (AR4). Available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

Figure 2-2
Global Temperature and Carbon Dioxide

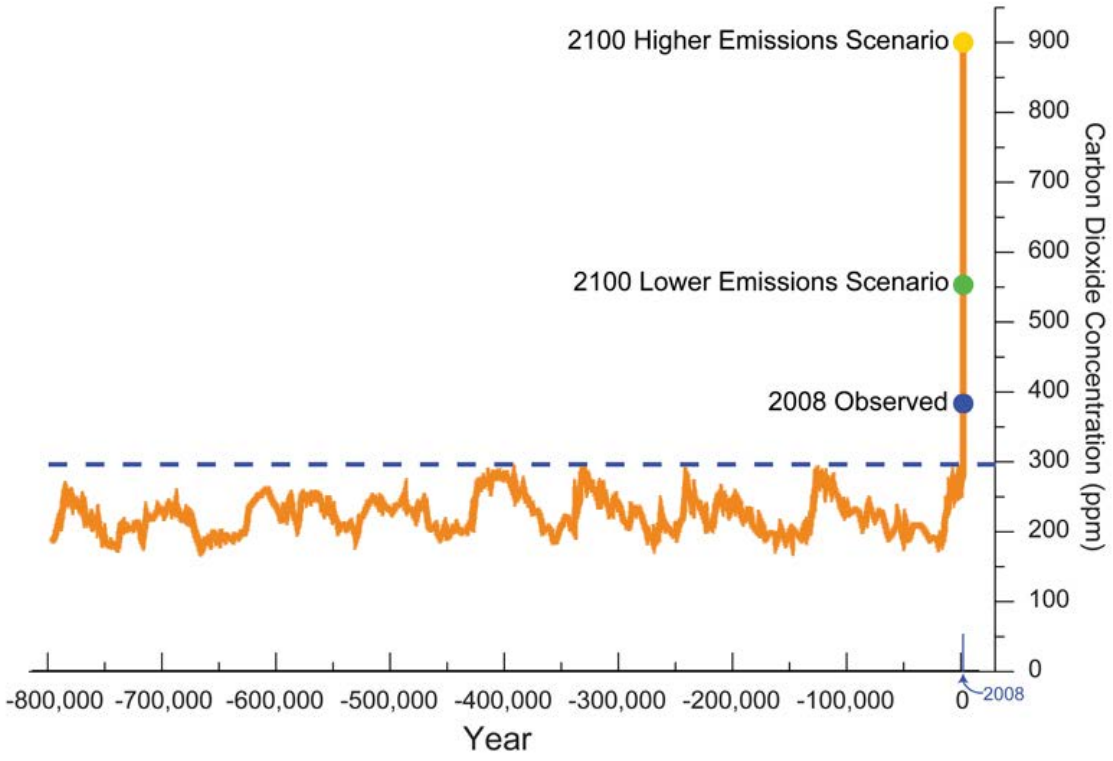



SOURCE: NOAA, 2010[3]

As shown in **Figure 2-3**, atmospheric CO2 levels have periodically risen and fallen over the past 800,000 years, within a relatively narrow range of approximately 180 to 300 parts per million (ppm), corresponding to repeating cycles of carbon uptake and release as continental ice sheets advance and retreat. The current era, already near the peak of an historical warming cycle, is experiencing atmospheric CO2 levels far higher than at any time over the past 800,000 years. Current concentrations are nearly 400 ppm, compared with approximately 280 ppm just 250 years ago.

Figure 2-3

800,000 Year Record of Carbon Dioxide (CO2) Concentrations



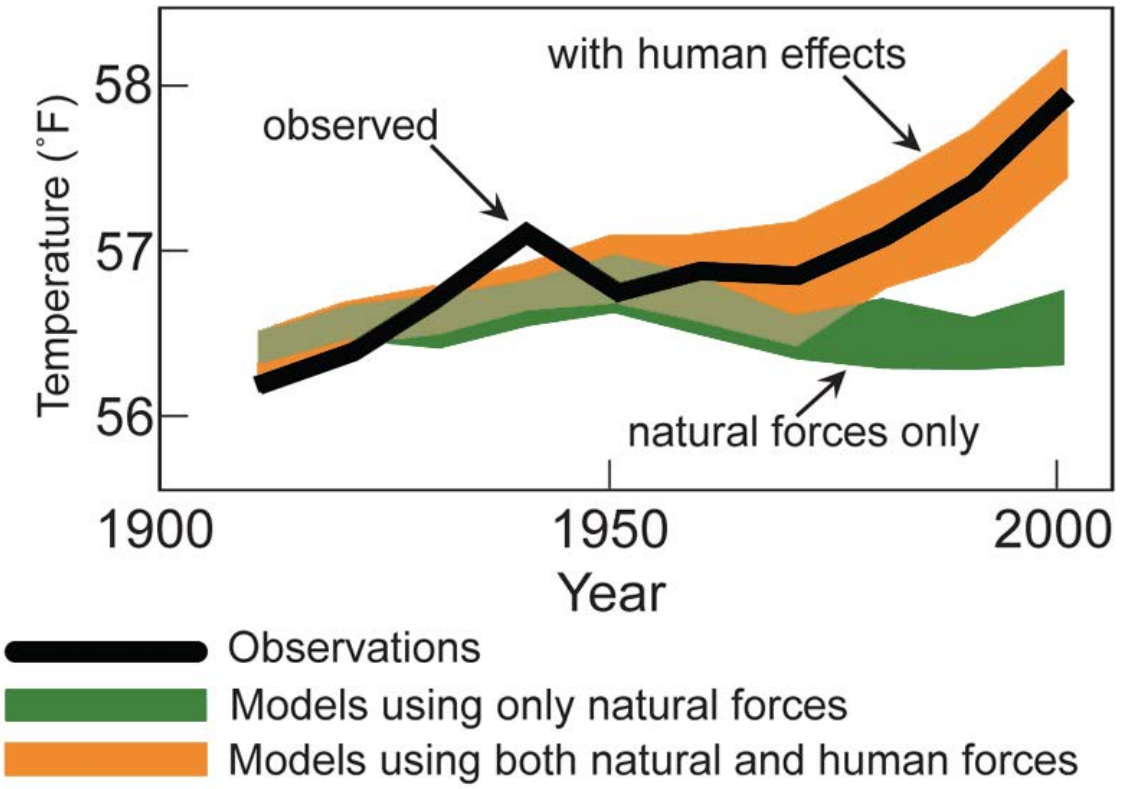

SOURCE: NOAA Satellite and Information Service[4]

By the end of the 21st Century, even the lower threshold of expected levels shown in **Figure 2-3** will far exceed known levels going back more than one million years. Climate models cited by the IPCC predict that by 2100, average atmospheric CO2 concentrations will increase to a range of 540–970 ppm, while global average temperatures are expected to rise between 1.1 and 6.4 °C (2.0 and 11.5 °F), with the greatest increases occurring at the poles. Already, observed average temperatures have increased by about 3°C at the poles since the 1980s, compared with 0.7 °C in the Earth's more temperate zones. Climate dynamics are complex, and predictions about our future climate include a level of uncertainty. Even so, current observations are consistent with modeling predictions and in many cases prove that the models are conservative.

An expanding body of scientific research supports the theory that human activity is a major contributor to observed increases in atmospheric CO2 and other GHGs. As shown in **Figure 2-4**, climate model experiments that include only natural factors, such as cycles of solar radiation variability, show a relatively

stable global temperature over the past century, while models that include human influences produce results that track very closely to the observed temperature increases over that same time period.

Figure 2-4
Climate Model Indications and the Observed Climate




SOURCE: NOAA, 2010

# Impacts of Climate Change

In 2009, a consortium of U.S.-based science organizations led by the National Oceanic and Atmospheric Administration (NOAA) released a comprehensive study of climate impacts in the United States.[5] Its key findings are summarized as follows:

1. Global warming is unequivocal and primarily human-induced.

   Average global temperature has increased over the past 50 years. This observed increase is due primarily to human-induced emissions of heat-trapping gases.

2. Climate changes are under way in the United States and are projected to grow.

   Climate-related changes have already been observed in the United States and its coastal waters. These changes include increases in heavy downpours, rising temperatures and sea level, rapidly retreating glaciers, thawing permafrost, lengthened growing seasons, lengthened ice-free seasons in the ocean and on lakes and rivers, earlier snowmelt, and alterations in river flows.

3. Widespread climate-related impacts are occurring now and are expected to increase.

Climate changes are already affecting water, energy, transportation, agriculture, ecosystems, and health. These impacts are different from region to region and will grow under projected climate changes.

4. Climate change will stress water resources.

   Access to clean water is an issue in every region, but the nature of the potential impacts varies. Drought—related to reduced precipitation, increased evaporation, and increased water loss from plants—is an important issue especially in the western U.S. Floods and water quality problems are likely to be amplified by climate change in most regions. Declines in mountain snowpack are important in the western states and Alaska, where snowpack provides vital natural water storage.

5. Crop and livestock production will be increasingly challenged.

   Agriculture is considered one of the sectors most adaptable to changes in climate. However, increased heat, pests, water stress, diseases, and weather extremes will pose adaptation challenges for crop and livestock production.

6. Coastal areas are at increasing risk from sea-level rise and storm surge.

   Sea-level rise and storm surges place many U.S. coastal areas at increasing risk of erosion and flooding, especially along the Atlantic and Gulf Coasts, Pacific Islands, and parts of Alaska. The Continental Pacific Coast is also at risk. Energy and transportation infrastructure and other property in coastal areas are very likely to be adversely affected.

7. Threats to human health will increase.

   Health impacts resulting from climate change are related to heat stress, waterborne diseases, poor air quality, extreme weather events, and diseases transmitted by insects and rodents. A robust public health infrastructure can reduce the potential for negative impacts.

8. Climate change will interact with many social and environmental stresses.

   Climate change will combine with pollution; population growth; overuse of resources; urbanization; and other social, economic, and environmental stresses to create larger impacts than from any of these factors alone.

9. Thresholds will be crossed, leading to large changes in climate and ecosystems.

   There are a variety of thresholds in the climate system and ecosystems. These thresholds determine for example the presence of sea ice and permafrost and the survival of species, from fish to insect pests, with implications for society.

10. Future climate change and its impacts depend on choices made today.

    The amount and rate of future climate change depend primarily on current and future human-caused emissions of heat-trapping gases and airborne particles. Responses involve reducing emissions to limit future warming and adapting to the changes that are unavoidable.

According to the IPCC Fourth Assessment Report, a 2°C increase in average global temperature over the next century is a “safe” level of global warming. To keep warming at this level, GHG concentrations must be stabilized at less than 450 parts per million (ppm). Currently, the global atmospheric concentration of GHGs averages nearly 400 ppm. Avoiding dangerous warming requires reducing global GHG emissions by at least 50 percent below 1990 levels by the year 2050. A target this aggressive is made especially challenging due to the current rapid rise of emissions in the developing world.

Many of California's important natural resources are threatened by the global warming trend. Increased precipitation and sea level rise could increase coastal flooding, saltwater intrusion (a particular concern in the low-lying Sacramento–San Joaquin Delta, where potable water supply pumps could be threatened), and degradation of wetlands. Mass migration and/or loss of plant and animal species, many unique to our Mediterranean climate, could also occur.

More information is available on the science of climate change from the following organizations:

- Intergovernmental Panel on Climate Change Fourth Assessment Report: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
- National Ocean and Aeronautical Administration (NOAA): http://www.climate.gov/#climateWatch
- Pew Center on Climate Change: http://www.pewclimate.org/
- U.S. Environmental Protection Agency: http://www.epa.gov/climatechange/indicators.html
- U.S. National Academy of Sciences: http://americasclimatechoices.org/
- The American Association for the Advancement of Science (AAAS): http://www.aaas.org/

## Expected Local Impacts

The City of Hughson, like other communities in California, is likely to face serious economic, social, and environmental challenges in the 21st Century due to climate change. Although Hughson is not susceptible to the projected rises in sea level due to melting ice caps and warming oceans, it will still be impacted directly and indirectly on many fronts as global temperatures rise.

The recently published *California Planning Adaptation Planning Guide: Understanding Regional Characteristics (July 2012)* designates climate impact regions based on county boundaries in combination with projected climate impacts, existing environmental setting, socioeconomic factors, and regional designations. The City of Hughson and Stanislaus County are located within the Northern Central Valley climate impact region. Within this region, the Adaptation Planning Guide identifies the following climate change impacts:

- Temperature increases (particularly nighttime temperature)
- Reduced precipitation
- Flooding (increase flows, snowmelt, levee failure in the Delta)
- Reduced agricultural productivity
- Reduced water supply
- Wildfire in the Sierra foothills
- Public health and heat
- Reduced tourism

**Temperature increases.** January temperatures are predicted to increase by about 4 to 6 degrees Fahrenheit by 2050 and between 8 to 12 degrees Fahrenheit by the year 2100 within the Northern Central Valley climate impact region. July increases in average temperatures are anticipated to be 6 to 7 degrees Fahrenheit and 12 to 15 degrees Fahrenheit by the year 2100. These increases would intensify already high temperatures, especially in the summer months. In addition, areas of urban development contain asphalt roads and concrete roofs that create and retain heat causing an urban heat island effect.

**Reduced precipitation.** Annual precipitation in Stanislaus County is predicted to decline by approximately one to two inches by the year 2050 and three to six inches by 2100. Reduced precipitation will adversely impact the water supply of the City, region, and State.

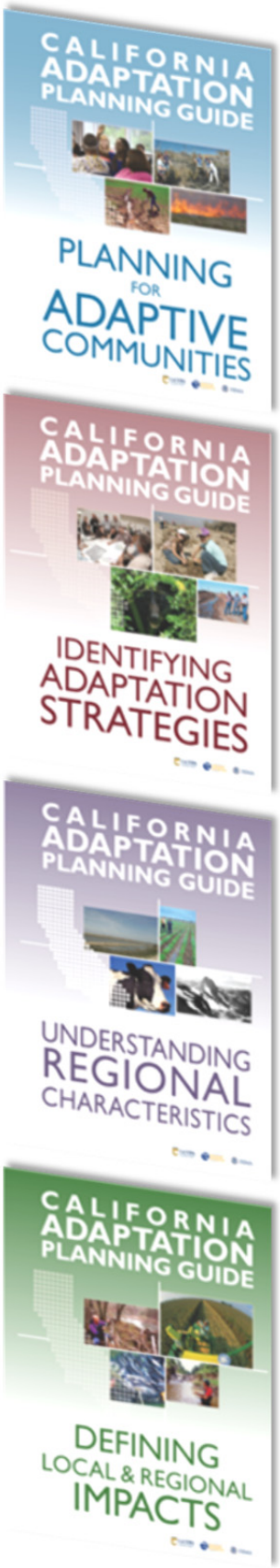
**Flooding.** The eastern part of the Northern Central Valley contains the foothills of the Sierra Nevada mountain range, which are projected to have less precipitation falling as snow and to be subject to rapid melt events. Thus, extreme, high flow events and flooding could occur in the City of Hughson and surrounding communities. The City of Hughson should evaluate local floodplains and determine areas of the City where a small increase in flood height would inundate a large area.

**Reduced agricultural productivity.** The agricultural industry is an important component of the local economy, and the Northern Central Valley region is one of the largest agricultural producing areas of the United States. Climate change impacts on water availability and temperature changes will likely affect the health of livestock and productivity of trees and crops. These impacts on agricultural productivity have the potential to alter a community's economy, including its employment base. The primary agricultural crop in the City of Hughson is almonds. Other crops include walnuts, peaches, apricots, beans, and milk. Each crop represents different vulnerabilities to climate change impacts. Specifically, nut trees would be affected by a reduction in nighttime cooling, while increased temperatures could influence the productivity of dairy cows.

**Reduced water supply.** Snowmelt from the Sierra Nevada flows west into the San Joaquin and Sacramento Rivers, which run through the region. The confluence of these two rivers occurs in the Sacramento-San Joaquin Delta, located northwest of Hughson and Stanislaus County. The water supply for the region consists of a combination of groundwater and surface water with a heavy reliance on the surface water conveyance systems that provide the inflow to the Sacramento-San Joaquin Delta. Relevant climate change impacts include reduced precipitation and increased temperatures, which affect water supply.

**Wildfires.** The north and eastern portions of the Northern Central Valley climate impact region are expected to experience an increase in wildfire risk. In some areas, the wildfire risk is anticipated to be more than four times the current levels. There is increased wildfire risk in the eastern portions of Stanislaus County; however, climate change is not expected to increase wildfire risk in Hughson.

**Public health and heat.** Extreme heat events can pose a public health risk to Hughson residents by increasing the prevalence of vector-borne diseases, worsened air quality, and heat-related illnesses. The Northern Central Valley climate impact region, which includes the City, will



experience two to three additional heat waves per year by 2050 with five to eight more by the year 2100. A heat wave is defined as five days over 102 to 105 degrees Fahrenheit. Frequent heat waves can have the greatest impact on the elderly and children less than five years of age.

# Policy and Regulatory Setting

Strategies for monitoring and addressing climate change have emerged at the international, national, and state levels, but California has been a leader in developing mitigation and adaptation strategies. Since 2005, California has been developing policy and passing legislation that seeks to control emissions of gases that contribute to global warming. These have included regulatory approaches, such as mandatory reporting for significant sources of GHG emissions and caps on emission levels, as well as market-based mechanisms, such as market-based cap-and-trade. Some regulations apply at the state level, but others are state-imposed mandates that are applicable at the municipal level and required of local agencies and jurisdictions.

## State of California Executive Order S-3-05

In June 2005, the Governor of California signed Executive Order S-3-05, which identified the California Environmental Protection Agency (Cal/EPA) as the lead coordinating state agency for establishing climate change emission reduction targets in California. A "Climate Action Team," a multi-agency group of state agencies, was set up to implement Executive Order S-3-05. The Governor's Executive Order established aggressive emissions reductions goals: by 2010, GHG emissions must be reduced to 2000 levels; by 2020, GHG emissions must be reduced to 1990 levels; and by 2050, GHG emissions must be reduced to 80 percent below 1990 levels. GHG emission reduction strategies and measures to reduce global warming were identified by the California Climate Action Team in 2006.

## Global Warming Solutions Act of 2006 (AB 32)

In 2006, the California legislature adopted AB 32, requiring that California cap GHG emissions state-wide at 1990 levels by 2020. AB 32 requires CARB to establish a program for statewide GHG emissions reporting, and monitoring/enforcement of that program.

The **Climate Change Scoping Plan**, adopted in 2008, outlines the State's plan to achieve the GHG reductions required in AB 32. The actions vary by type, which include direct regulations, alternative compliance mechanisms, incentives, voluntary actions, and other mechanisms. The Scoping Plan identifies local governments as "essential partners" in achieving California's goals to reduce GHG emissions, encouraging the adoption of reduction targets for community and municipal operations emissions that are consistent with the State's commitment (identified as equivalent to 15% below "current" levels). The Scoping Plan includes the following high-impact State measures that target emissions from transportation and power generation. Each is expected to provide significant emissions reduction benefits for the City of Hughson.

## Low Carbon Fuel Standard (LCFS)

The Low Carbon Fuel Standard (LCFS) requires fuel providers in the State to decrease lifecycle fuel carbon intensity by 2020. The LCFS applies, either on a compulsory or opt-in basis, to all fuels used for transportation in California. It is expected that the LCFS will reduce tailpipe carbon emissions from passenger vehicles

and heavy duty trucks by approximately 10 percent by 2020[1]. CARB identified specific eligibility criteria in April 2009, and the regulation became effect in January 2010. In December 2011, the U.S. District Court for the Eastern District of California issued rulings that struck down the LCFS for violation of the Commerce Clause of the U.S. Constitution and enjoined its further enforcement. CARB appealed the ruling the following month. It is assumed for the time being that the LCFS will be ultimately implemented by 2020 as proposed. If the LCFS were ultimately to be blocked from implementation, the emission reductions described in this CAP would be adjusted downward accordingly.

## Assembly Bill 1493 (Pavley)

Assembly Bill 1493, known as the Pavley Bill, directed CARB to adopt regulations to reduce emissions from new passenger vehicles. AB 1493 requires GHG emission reductions from passenger trucks and light cars beginning in 2011. CARB's AB 32 Early Action Plan released in 2007 included a strengthening of the Pavley regulation for 2017. The U.S. EPA granted California the authority to implement GHG emission reduction standards for new passenger cars, pickup trucks and sport utility vehicles in June 2009. In September, CARB adopted amendments to the regulations that reduce GHG emissions in new passenger vehicles from 2009 through 2016. It is expected that the Pavley regulations will reduce GHG emissions from California passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016, all while improving fuel efficiency and reducing motorists' costs.

## Senate Bill 1078 (SB 1078)

California's Renewable Portfolio Standard (RPS) was established in 2002 under SB 1078 and accelerated in 2006 under SB 107. The program was further expanded in 2011 under SB 2. Under AB 32, the Renewable Portfolio Standard requires increased production of energy from renewable sources, like solar, wind, geothermal, and biomass generation. Investor-owned utilities, electric service providers, and community choice aggregators must increase their renewable portfolio to reach 33 percent of total procurement by 2020. Turlock Irrigation District (TID) expects to exceed 33 percent of its retail energy sales with eligible renewable resources in 2013.[6]

## 2008 Building Energy Efficiency Standards (2008 Title 24 Update)

In 2008, the California Energy Commission (CEC) updated the California Code of Regulations (CCR), Title 24 of the California Energy Code, to enhance the energy efficiency requirements of newly constructed buildings. The 2008 standards were adopted on April 23, 2008, and went into effect on January 1, 2010. The update to the Code supports the goals as described in AB 32, by enhancing energy efficiency of all new residential and non-residential development. It is expected that the 2008 update will reduce GHG emissions from California residential buildings for electricity by approximately 21% and natural gas by 9%, and non-residential buildings for electricity by approximately 5% and natural gas by 9%. A further update to Title 24 (the 2013 Standards) is expected to be effective on January 1, 2014.

[1] Equal to 7% when full lifecycle impacts are considered.

## Senate Bill 97 (SB 97)

Recognizing that AB 32 did not discuss how GHGs should be addressed in documents prepared under the California Environmental Quality Act (CEQA), the legislature enacted SB 97 to require the Governor's Office of Planning and Research (OPR) to develop and adopt CEQA guidelines for the mitigation of emissions. The draft guidelines were formalized on March 18, 2010, and all CEQA documents prepared after this date are required to comply with the OPR-approved amendments to the CEQA Guidelines.

## Senate Bill 375 (SB 375)

In 2008, SB 375 was enacted to address indirect GHG emissions caused by urban sprawl. SB 375 develops emissions-reduction goals that regions can apply to planning activities. SB 375 provides incentives for local governments and developers to create new walkable and sustainable communities, revitalize existing communities, and implement conscientiously planned growth patterns that concentrate new development around public transportation nodes. CARB has been working with the state's metropolitan planning organizations (MPOs) to align their regional transportation, housing, and land use plans to reduce vehicle miles traveled and demonstrate the region's ability to attain its GHG reduction targets. The legislation also allows developers to bypass environmental review of the project's GHG impact under CEQA if they build projects consistent with the MPO's Sustainable Community Strategy (SCS). SB 375 enhances CARB's ability to reach the goals of AB 32 by directing the agency to develop regional GHG emission reduction targets to be achieved from the land use and transportation sector for 2020 and 2035.

In September 2010, CARB adopted *placeholder* per capita emissions reduction targets for the San Joaquin Valley (including 8 planning organizations) of 5 percent and 10 percent, respectively, to be revised in 2012. On December 14, 2012, the Policy Council adopted a Progress Report that maintained these target recommendations.

## Governor's Office of Planning and Research (OPR)

The California Governor's Office of Planning and Research (OPR) provides guidance for agency compliance with the California Environmental Quality Act (CEQA), which requires that lead agencies analyze and document the environmental impacts of proposed projects. OPR has developed guidance on the analysis and mitigation of GHG emissions in CEQA documents. This guidance states that lead agencies should develop their own approach to performing climate change analysis for projects that generate GHG emissions, and that compliance with CEQA can be achieved by identification and quantification of GHG emissions, assessment of significance of the impact on climate change, and identification of mitigation measures and/or alternatives if the impact is found to be significant.

OPR developed, and the California Resources Agency has adopted, amendments to the *CEQA Guidelines* to incorporating this guidance. *CEQA Guidelines* Section 15183.5(b) states that a lead agency may choose to analyze and mitigate significant greenhouse gas emissions in a plan for the reduction of greenhouse gases or similar document, and that such a plan may be used in a cumulative impacts analysis of a project. A lead agency may determine that an individual project's incremental contribution to a cumulative effect on climate change is not cumulatively considerable if the project complies with the requirement of the previously adopted plan to reduce greenhouse gas. This plan should:

- Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;

- Establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable;
- Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area;
- Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level;
- Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels; and
- Be adopted in a public process following environmental review.

## San Joaquin Valley Air Pollution Control District (SJVAPCD)

The San Joaquin Valley Air Pollution Control District (SJVAPCD) is a public health agency that regulates air pollution within the San Joaquin Valley. Under SJVAPCD regulation and stewardship, air quality in the San Joaquin Valley has steadily improved over the past 15 years.

In August 2008, the San Joaquin Valley Air Pollution Control District's Governing Board adopted the Climate Change Action Plan (CCAP). The CCAP directed the District Air Pollution Control Officer to develop guidance to assist Lead Agencies, project proponents, permit applicants, and interested parties in assessing and reducing the impacts of project specific greenhouse gas emissions on global climate change,

SJVAPCD adopted guidance for addressing GHGs in CEQA documents in December 2009. The SJVAPCD proposed a threshold based on implementing predetermined Best Performance Standards that would reduce emissions by an amount consistent with AB 32 targets. The guidance for land use projects is intended to assist local agencies, but local agencies are not required to use the SJVAPCD thresholds.

Under the SJVAPCD guidance, projects requiring project specific environmental review would be evaluated according to a Best Performance Standards approach. Projects complying with the GHG emission reduction requirements established as Best Performance Standards would not require project specific quantification of GHG emissions and would be determined to have a less than significant individual and cumulative impact for GHG emissions. Projects not complying with the GHG emission reduction requirements established as Best Performance Standards would require quantification of project specific GHG emissions. To be determined to have a less than significant individual and cumulative impact on global climate change, project specific GHG emissions must be reduced or mitigated by 29 percent from Business-as-Usual GHG emissions.

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1 Intergovernmental Panel on Climate Change Fourth Assessment Report, 2007. Available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
2 University of Cambridge, 2006. The Greenhouse Effect. Accessed on June 14, 2011, www-g.eng.cam.ac.uk/impee/?section=topics&topic=ClimateChange&page=materials
3 NOAA Satellite and Information Service, www.ncdc.noaa.gov/indicators/, 2010.
4 NOAA Satellite and Information Service, 2010, www.ncdc.noaa.gov/indicators/
5 U.S. Global Change Research Program, 2009. Global Climate Change Impacts in the United States. Page 12, www.globalchange.gov/publications/reports/scientific-assessments/us-impacts ,
6 Modesto Irrigation District, Redding Electric Utility, and Turlock Irrigation District, "Memorandum: Docket No. 11-RPS-01," March 30, 2012, www.energy.ca.gov/portfolio/documents/2012-03-01_workshop/comments/Comments%20of%20MID-REU-TID%20on%20the%2033%20Percent%20RPS.pdf, accessed April 17, 2012.

# 3 GHG Emissions Inventory, Forecasts, and Targets

A city's GHG inventory quantifies the GHG emissions resulting from activities of the city's residents, businesses, and local government. An inventory creates an emissions baseline against which the city can set reduction targets and measure future progress. It also allows the city to develop effective policies, strategies, and programs to reduce emissions. For the City of Hughson, the year 2005 is used as the inventory base year, following California Air Resources Board (CARB) guidance.

In 2012, ICF International (ICF) developed the City of Hughson's first community-wide GHG inventory to establish baseline emissions for 2005 (see Appendix A). The City of Hughson's community-wide inventory encompasses the GHG emissions resulting from activities taking place within the City's geopolitical boundary, where the local government has jurisdictional authority, as well as some activities taking place outside of the jurisdictional boundary that the community impacts (for example, solid waste generated that is sent to landfill area outside of Hughson). The 2005 baseline inventory, included here, includes emissions from the following sectors: agriculture, residential energy use, commercial/industrial energy use, on-road and off-road transportation, solid waste generation, water, wastewater, and stationary sources[7].

# 2005 Community Inventory

## Inventory Categories

In the community inventory, baseline emissions are categorized into sectors based on their source(s), as follows:[8]

- *Agriculture:* Farming results in emissions of greenhouse gases from manure management, enteric fermentation, fertilizer use, and fuel combustion from agricultural vehicle operation.
- *Building Energy* (Electricity and Natural Gas): Buildings consume electricity and natural gas for daily operations and heating / cooling. The "commercial" classification includes all non-residential building energy use, including municipal government buildings, industrial buildings, and commercial buildings. This category includes all energy services provided by the local utilities: PG&E and TID.
- *Transportation:* On-road and off-road vehicle use results in combustion of fossil fuels, which emit greenhouse gases into the atmosphere. These emissions are considered "mobile."

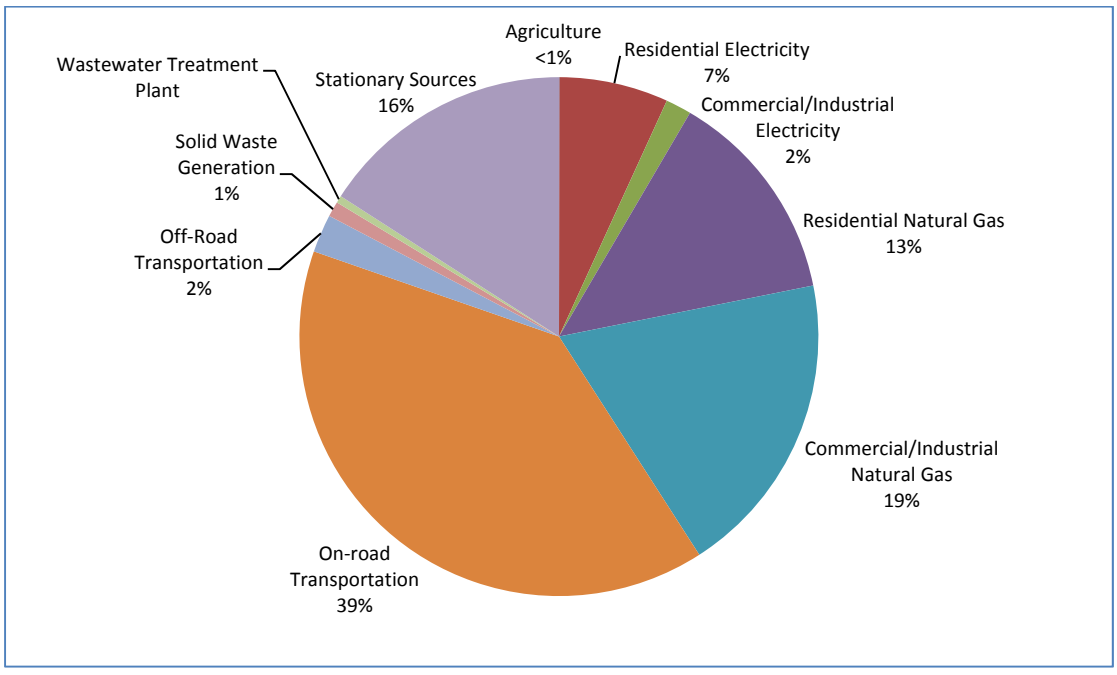
- *Water:* The delivery and consumption of water to residents and businesses requires storage and pumping, and other mechanical processes that consume energy.
- *Solid Waste:* The disposal of solid waste in landfills causes anaerobic decomposition, which results the emission of greenhouse gases ($CH_4$).
- *Wastewater:* Emissions in this sector are associated with the treatment of community industrial, residential, and commercial wastewater.
- *Stationary Sources:* A stationary source, broadly, is a fixed emitter of air pollutants, such as fossil fuel burning power plants, petroleum refineries, food processing plants, chemical plants, and other heavy industrial sources. These emissions are the result of combustion and other chemical processes not included in the energy service of PG&E and TID. These stationary sources do not include emissions from utility-provided natural gas because those emissions are included in the "Building Energy" category. Stationary source emissions are regulated by (and require a permit with) the San Joaquin Valley Air Pollution Control District (SJVAPCD).

## Inventory Results

The baseline 2005 GHG Inventory for the City of Hughson totals 32,643 metric tons (MT) of carbon dioxide equivalents (CO2e), including residential, commercial, industrial, and municipal operations emissions. This baseline community inventory provides a breakdown of GHG emissions by sector in the community, as shown in **Figure 3-1** and **Table 3-1**. Emissions from transportation (both on-road and off-road) contributed a combined 42 percent of total emissions, closely followed by residential and commercial building (combined electrical and natural gas use), at 41 percent of all emissions. Stationary sources accounted for about 16 percent.

Figure 3-1

2005 Community Emissions by Sector




SOURCE: ICF, 2012

Table 3-1
2005 Community Emissions by Sector (CO2E MT)

| Emission Sector | Total | % Total |
|---|---|---|
| Agriculture | 11 | <0.1% |
| Residential Electricity | 2,218 | 6.8% |
| Commercial/Industrial Electricity | 525 | 1.6% |
| Residential Natural Gas | 4,375 | 13.4% |
| Commercial/Industrial Natural Gas | 6,223 | 19.1% |
| On-road Transportation | 12,868 | 39.4% |
| Off-road Transportation | 776 | 2.4% |
| Solid Waste Generation | 311 | 1.0% |
| Water* | 0 | 0.0% |
| Wastewater Treatment Plant | 147 | 0.5% |
| Stationary Sources | 5,189 | 15.9% |
| TOTAL | 32,643 | 100.0% |

**SOURCE: ICF, 2012; A Factors may not total exactly due to rounding**

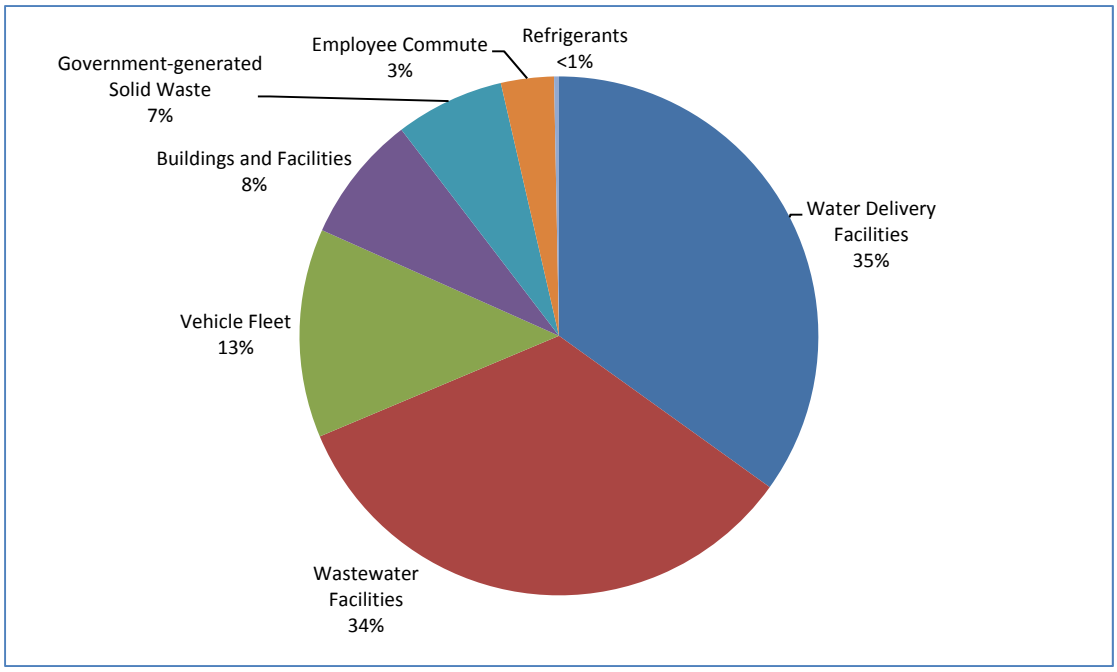
*** In the Community inventory, ICF included water-related emissions (443 MT CO2e, according to ICLEI's Municipal GHG inventory) in residential and commercial electricity categories**

# 2005 Municipal Inventory

A municipal GHG inventory identifies the sources and quantities of emissions generated by local government operations. In August 2011, ICLEI developed the City of Hughson's GHG municipal inventory to establish baseline emissions for 2005 (see Appendix B). ICLEI's inventory (summarized in **Figure 3-2** and **Table 3-2**) shows that Hughson's government operations in 2005 were responsible for approximately 1,270 MT CO2e. Emissions from municipal operations represent approximately 3.9 percent of the total community-wide inventory. The biggest source of municipal operations emissions are Wastewater Facilities (33.8 percent). Water Delivery Facilities (34.9%), Vehicle fleet (13.0 percent), Government-generated Solid Waste (6.8 percent), and energy use in Buildings and Facilities (7.9%) were also important contributors to total emissions. Wastewater Facilities emissions include process and fugitive emissions from wastewater treatment processes, and energy used by the facility.

Figure 3-2

2005 Municipal Emissions by Sector




Source: ICLEI, 2011

Table 3-2

2005 Municipal Operations Emissions by Sector (CO2E MT)

| Emission Sector | Emissions | % Total Emissions |
|---|---|---|
| Water Delivery Facilities | 443 | 34.9% |
| Wastewater Facilities | 429 | 33.8% |
| Vehicle Fleet | 165 | 13.0% |
| Buildings and Facilities | 101 | 7.9% |
| Government-generated Solid Waste | 86 | 6.8% |
| Employee Commute | 42 | 3.3% |
| Refrigerants | 4 | 0.3% |
| TOTAL | 1,270 | 100.0% |

SOURCE: ICLEI, 2011: Factors may not total exactly due to rounding

# Demographic Projections

In order to project emission forecasts for the future as accurately as possible, it needs to be based on reasonable growth projections. The Hughson General Plan was adopted in 2005, right before the economic downturn. Thus, the population and employment growth projections in the 2005 General Plan are very high and unlikely to occur by the buildout horizon year of 2035. A more recent source for demographic forecasts is the projections developed by the Stanislaus County Council of Governments (StanCOG) jointly with the City of Hughson for the Regional Transportation Impact Fee (RTIF) in mid-2012.[9] Since then, it has become clear that with an improving economy, the City has seen an increase in growth and development application inquiries; thus, realistic projections fall somewhere in between the 2005 General Plan and StanCOG forecasts. As such, the Hughson Climate Action Plan utilizes the demographic forecasts shown below in **Table 3-3**, derived from these two forecasts but informed by the City's knowledge of local development trends.

Table 3-3
City of Hughson Growth Projections

| | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| Population | 6,091 | 6,640 | 7,012 | 7,660 | 8,000 | 8,500 |
| Employment (Jobs) | 749 | 580 | 624 | 700 | 800 | 900 |
| Housing (DUs) | 1,915 | 2,234 | 2,291 | 2,550 | 2,750 | 3,000 |

# Emissions Forecast

The future-year forecasts establish annual projections for future-year emissions under "business-as-usual" (BAU) conditions. If the City of Hughson were to continue its 2005 patterns of vehicular travel, energy consumption, waste generation and disposal, and water consumption, it would be considered business-as-usual. BAU emissions are described as GHG emissions that would take place in the absence of strategies designed to reduce emissions over time. GHG reduction programs, policies and strategies developed after 2005 create a condition that is "beyond business-as-usual."

BAU projections were developed using Hughson's estimates for population, housing, and employment growth within the City boundaries by 2020 that are influenced by the 2005 City of Hughson General Plan and demographic forecasts by the Stanislaus County Council of Governments (StanCOG), as described in the preceding section. These population, housing, and employment growth projections were applied as appropriate to each emissions sector in the 2005 base year inventory to determine future year projections.

Hughson's annual community emissions, inclusive of municipal emissions, are projected to increase over time. In the year 2020, emissions are expected to be approximately 35,901 MT CO2e in the year 2020, which represents an approximate 10 percent increase from 2005 baseline conditions (Note that this is double the growth forecasted by StanCOG). In the year 2030, emissions are projected to increase to about 43,423 MT CO2e, which represents an increase of approximately 33 percent from 2005 baseline conditions.

Projected community GHG emissions by sector for 2005, 2020, and 2030 are presented in **Table 3-4**. Transportation is expected to contribute the largest share of emissions through 2020. **Figure 3-3** provides

a graphical representation of projected 2020 community emissions. It should be noted that the percentage contribution by sector in 2030 was similar to 2020.

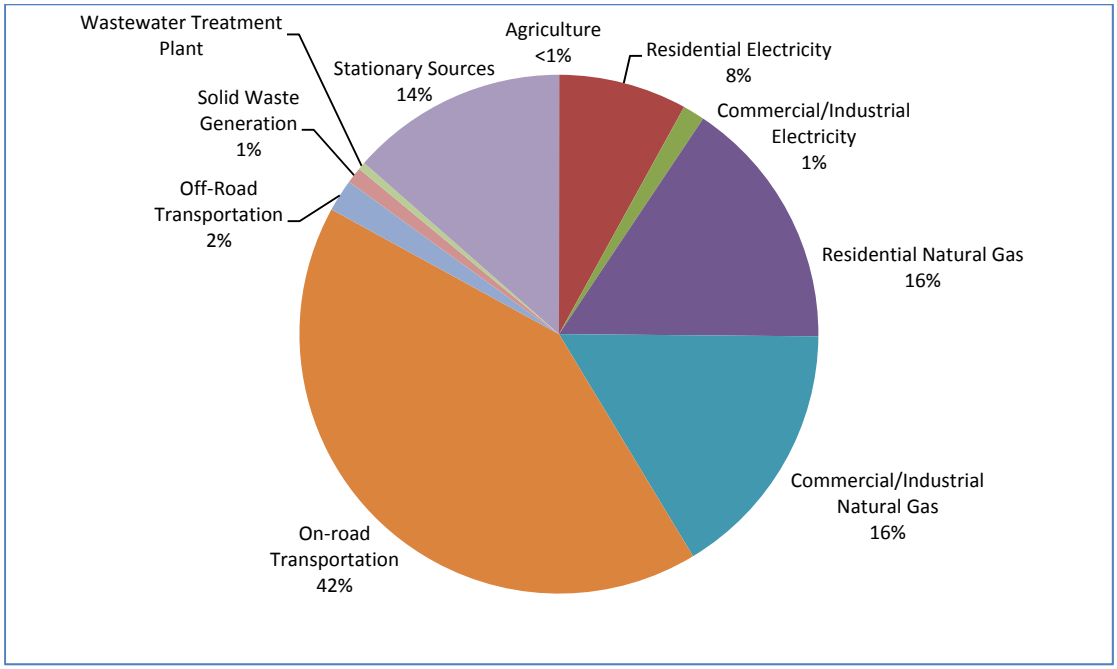
Table 3-4

Projected Business-As-Usual Community-Wide GHG Emissions by Sector (CO2E MT)

| | Baseline Conditions | | Future Year Projection | | Future Year Projection | |
|---|---|---|---|---|---|---|
| Emission Sector | 2005 | % Total | 2020 | % Total | 2030 | % Total |
| Agriculture | 11 | <0.1% | 9 | 0.0% | 8 | 0.0% |
| Residential Electricity | 2,218 | 6.8% | 2,870 | 8.0% | 3,280 | 7.6% |
| Commercial/Industrial Electricity | 525 | 1.6% | 491 | 1.4% | 631 | 1.5% |
| Residential Natural Gas | 4,375 | 13.4% | 5,662 | 15.8% | 6,469 | 14.9% |
| Commercial/Industrial Natural Gas | 6,223 | 19.1% | 5,816 | 16.2% | 7,478 | 17.2% |
| On-road Transportation | 12,868 | 39.4% | 14,952 | 41.6% | 17,759 | 40.9% |
| Off-road Transportation | 776 | 2.4% | 725 | 2.0% | 932 | 2.1% |
| Solid Waste Generation | 311 | 1.0% | 361 | 1.0% | 429 | 1.0% |
| Wastewater Treatment Plant | 147 | 0.5% | 171 | 0.5% | 203 | 0.5% |
| Stationary Sources | 5,189 | 15.9% | 4,850 | 13.5% | 6,235 | 14.4% |
| TOTAL | 32,643 | 100.0% | 35,907 | 100.0% | 43,424 | 100.0% |

Figure 3-3

2020 Community Emissions by Sector[10]




# Emissions Reduction Target

The City of Hughson is adopting a community-wide emissions reduction target of 15 percent below 2005, following guidance from the CARB and the Governor's Office of Planning and Research. This is deemed by

CARB and the California Attorney General to be consistent with the state-wide AB 32 goal of reducing emissions to 1990 levels.[11]

As described above, the City of Hughson's municipal operations are expected to contribute 1,366 MT CO2e of the community's 35,907 MT CO2e in 2020, or approximately 4 percent of the total. This proportion is expected to remain the same in 2030, when the City's municipal operations are expected to contribute approximately 4 percent of total community emissions. However, the City has the ability to affect a much larger portion of community GHG emissions, including emissions associated with land use patterns and their integration with transportation systems, as well as community-wide energy efficiency, energy procurement, actions to reduce waste sent to landfill, and more.

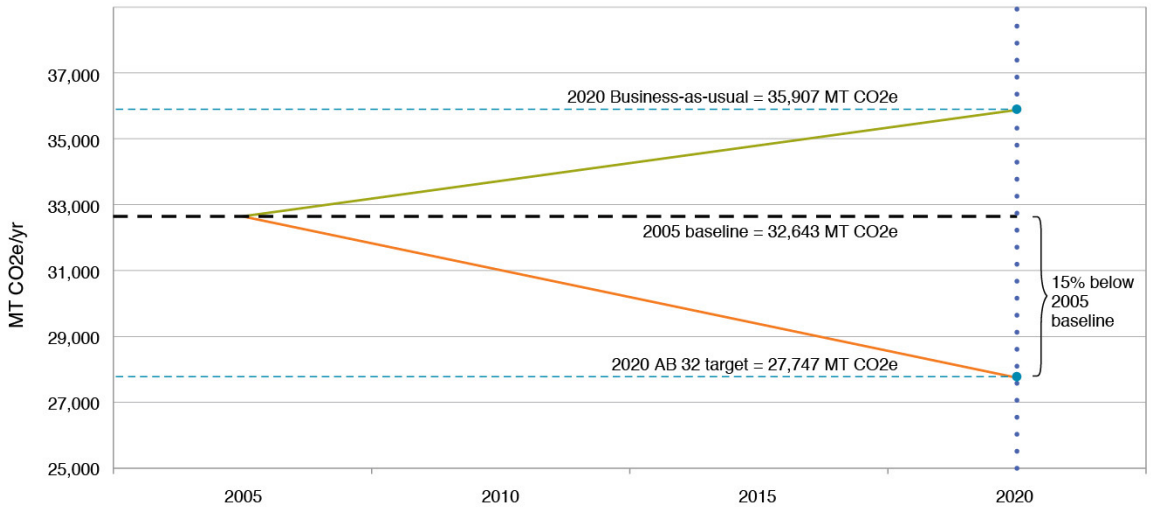
As further described in Chapter 6, progress toward achieving the 2020 emissions reduction target will be monitored over time through preparation of an annual memorandum documenting program implementation and performance. At each monitoring juncture, the City Council may adjust or otherwise modify the strategies, as needed, to achieve the reductions needed to reach the target. Such adjustments could include more prescriptive measures, different allocations in funding, and modifications to the 2020 BAU emissions projection and reduction target based on revised population, housing, and employment growth estimates. Additionally, the City will update the emissions inventory every 5 years to track overall progress toward meeting the GHG reduction target.

## Community Emissions

The Community's 2020 emissions target is 27,747 MT CO2e, equivalent to a 15 percent reduction from 2005 baseline emissions of 32,643. This is a net annual reduction of 8,160 MT CO2e from the forecasted 2020 BAU emissions forecast of 35,907 MT CO2e. The community-wide emissions reduction target is depicted graphically in **Figure 3-4**.

Figure 3-4

Projected Community-Wide Greenhouse Gas Emissions and Reduction Target for 2020




## Municipal Operations Emissions

A reduction target for municipal operations emissions is appropriate because many of the strategies included in this Climate Action Plan apply to facilities or operations under the direct control of the City.

Under the BAU scenario, emissions from municipal operation are projected to rise approximately commensurate with the City's population growth, from a 2005 baseline of 1,270 MT CO2e to 1,627 MT CO2e in 2020, and to 1,950 MT CO2e in 2030. Applying the 15 percent reduction below 2005 emissions results in a 2020 target of 1,079 MT CO2e, representing a required reduction of approximately 548 MT CO2e from 2020 BAU.

## Impact of State Emissions Reductions Measures

Several high-impact state-wide measures included in the AB 32 Scoping Plan target emissions from transportation and power generation. As described in Chapter 3, the Low Carbon Fuel Standard (LCFS), the Pavley Bill for reducing passenger vehicle emissions (AB 1493), and the Renewable Portfolio Standard (RPS) are each expected to provide significant emissions reduction benefits for the City of Hughson.

The impacts of the Pavley Bill and the LCFS are modeled through CARB's EMFAC 2011 software. Combined, these measures are projected to reduce on-road transportation GHG emissions state-wide by 21.7 percent by 2020 and 25.9 percent by 2030.

The RPS requires renewable energy to be equivalent to at least one third of a utility's electricity portfolio by 2020. For TID, approximately 21.7 percent of its 2005 portfolio qualified under the RPS rules and thus the impact of the RPS is projected to result in approximately an additional 11.6 percent of its portfolio coming from renewable energy sources by 2020. Taken overall, the RPS will reduce the City's total emissions by approximately 2 percent from the 2020 and 2030 business-as-usual projections.

California' 2008 Update to Title 24 (the CEC Building Energy Efficiency Program) became effective on January 1, 2010, and requires building efficiency improvements above and beyond previous standards. The 2013 update to Title 24 becomes effective on January 1, 2014, and is expected to reduce residential and non-residential energy usage by 25% and 30%, respectively, over the 2008 Title 24 code.[12]

The collective impact of State-wide measures on the community-wide business-as-usual inventory projection is presented in **Table 3-5**. By 2020, these measures are expected to reduce 2020 community-wide GHG emissions by an estimated 13.6 percent.

Table 3-5

Predicted Effect of State-Wide Measures on Community-Wide GHG Emissions (MT CO2e/Year)

| Year | Total Business-as usual (BAU) | Pavley and LCFS Impact | RPS Impact | Title 24 Impact | Total with State Measures | Reduction from BAU | Reduction from BAU |
|---|---|---|---|---|---|---|---|
| 2020 | 35,907 | -3,244 | -732 | -928 | 31,003 | 4,904 | -13.6% |
| 2030 | 43,424 | -4,601 | -852 | -1,936 | 36,036 | 7,388 | -17.0% |

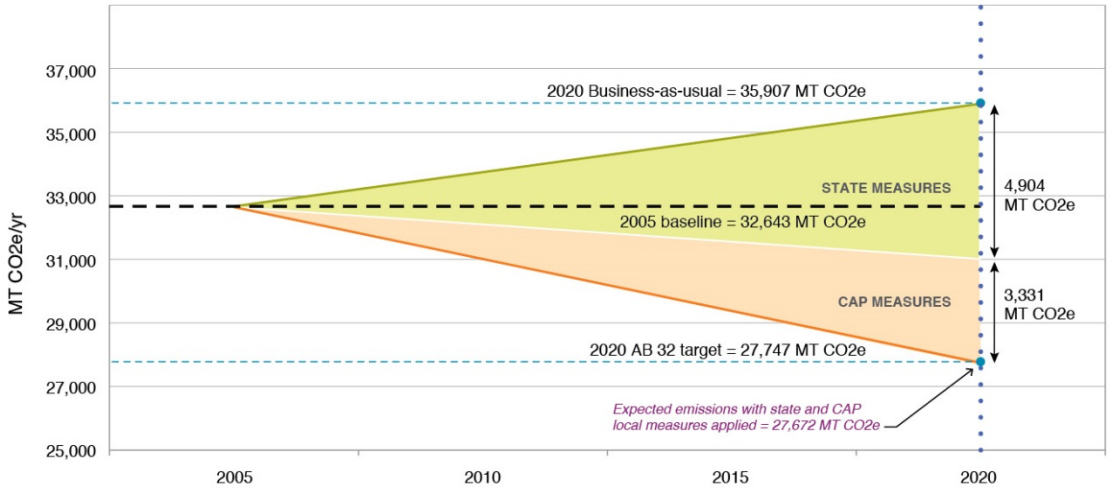
# The City of Hughson's GHG Reduction Target

## 2020 Target

To be consistent with AB 32 goals, Hughson will reduce its community-wide GHG emissions to 15 percent below 2005 levels in 2020, to 27,747 MT CO2e from 35,907 MT. As discussed above, the state-wide reduction measures are expected to reduce emissions by 4,904 MT CO2e below BAU by 2020 (13.6%). Therefore, Hughson is left with the challenge of reducing community emissions by an additional 3,256 MT CO2e per year below business-as-usual by 2020. **Figure 3-5** depicts this target. As outlined in the next chapter, CAP strategies are expected to reduce community-wide emissions by 3,331 MT CO2e per year by 2020, exceeding the target by approximately 2 percent (75 MT CO2e).

Figure 3-5

Predicted Effect of State-Wide and CAP Measures on Community-Wide GHG Emissions by 2020




The corresponding challenge for city government is to reduce emissions from municipal operations to 1,079 MT CO2e by 2020, a target equivalent to reducing annual emissions by 548 MT CO2e from business-as-usual projections. The emissions reduction strategies presented in the following chapter of this Climate Action Plan are designed to enable the City of Hughson to achieve these targets.

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7 The Refrigerants/High GWP sector was calculated by ICF but not included in the inventory here, since the sector is subject to significant City influence. Additionally, results for this sector (as calculated by ICF) are calculated by a top-down approach, being apportioned from State-wide figures, and therefore do not provide a high level of accuracy.

8 ICF, Inc. "Stanislaus Countywide Regional Greenhouse Gas Inventory," November, 2012.

9 StanCOG RTIF Demographic Projections, July 2012.

10 Percentage contributions of sectors remained the same in 2020 as in 2030.

11 In its Climate Change Scoping Plan of September 2008, CARB recommends that local governments adopt a GHG reduction target consistent with the State's commitment to reach 1990 levels by 2020. This is identified as equivalent to either 15% below 2005 levels by 2020 or a 28% reduction below BAU forecasts by 2020.

12 Based on expected electricity and natural gas savings as described in the California Energy Commission's 2008 Rulemaking standards,, available here: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF, and a 2013 study by UC Davis available here: http://cltc.ucdavis.edu/sites/default/files/files/publication/title-24-2013-code-changes_1.pdf

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# 4 Greenhouse Gas Reduction Goals and Strategies

## Overview

This chapter describes the strategies that the City of Hughson plans to implement to reduce GHG emissions and work toward the reduction target described in Chapter 4. To be consistent with AB 32 and SJVAPCD guidelines, Hughson must reduce its community-wide GHG emissions to 15 percent below 2005 levels, or to 27,747 MT $CO_2e$; this is equivalent to 8,160 MT $CO_2e$ below the City's business-as-usual (BAU) forecast for 2020. The impacts of the statewide GHG reduction measures (included in the AB 32 Scoping Plan) account for annual emissions reductions of 4,904 MT $CO_2e$, leaving (a remainder of) 3,256 MT $CO_2e$ to be reduced by the strategies described herein.

GHG reduction goals and strategies are presented for four different sectors: Energy, Transportation and Land Use, Solid Waste, and Water. Each section begins with a summary of the GHG reductions anticipated from the sector, followed by a discussion of individual strategies and implementing actions. Detailed calculations used to quantify the costs and emissions reductions associated with individual strategies and actions are included in Appendix C. City municipal strategies are included within each relevant sector, where appropriate. In total, locally implemented strategies and measures are expected to reduce GHG emissions by 3,331 MT CO2e by the year 2020, thereby exceeding the reduction target by 75 MT CO2e.

## Strategy Classification and Coding

The City of Hughson has significant policy influence over four main sectors of the City's GHG emissions profile: Energy, Transportation & Land Use, Solid Waste, and Water.

For each of the four sectors, one or more goals, strategies, and actions are provided:

**Goals** are general statements of aspiration or intent to achieve a desired condition. There are one or more goals for each of the four sectors, and each goal is labeled according to the sector it is associated with, as follows: Energy Section (E), Transportation & Land Use (T or LU), Solid Waste (SW), and Water (W). For example, Goal E-1 is the first goal of the Energy sector.

**Strategies** are a course of action to be undertaken by the City to meet the goals related to climate change. Each strategy is designated a code that corresponds to its sector and goal. As an example, Strategy SW-2.1 is the first strategy of the second goal for the Solid Waste Sector.

**Actions** are detailed steps the City will take to implement the strategies. Each action was carefully considered by the City to ensure that appropriate staff and resources would be available for implementation. Each action is also designated a code that corresponds to the goal and strategy it will implement. For example, Action SW-2.1a is associated with Strategy 2.1, which in turn is associated with Goal SW-2.

The goals, strategies, and actions are organized using the following numeric order:

Sector (E, TLU, SW, W)

- Goal 1
  Strategy 1.1
  Action 1.1a
- Goal 2
  Strategy 2.1
  Action 2.1a

Each strategy was evaluated to identify the greatest opportunities for GHG reduction that can be achieved with minimum cost. The City estimated the upfront costs and ongoing staff resources needed for strategy implementation (e.g., low, medium, high), as well as the anticipated energy, GHG, and cost reduction benefits (e.g., minimal or indirect, moderate, high). Strategies in this chapter are broadly prioritized as 1 (high priority), 2 (medium priority), and 3 (low priority), based on the following matrix:

Table 4-1
Prioritization of Community Strategies

| | | Costs | | |
|---|---|---|---|---|
| | | Low | Medium | High |
| Benefits | High | 1 | 1 | 2 |
| | Medium | 1 | 2 | 3 |
| | Low | 2 | 3 | 3 |

Strategies were evaluated for estimates of GHG reductions to be achieved by 2020 resulting from implementation, along with estimated annual cost savings by 2020 based on expected energy savings. Priority 1 strategies are assumed to have a high or medium GHG reduction benefit, along with low or medium cost. Priority 3 strategies are strategies that have low or medium GHG reduction benefit, along with medium or high cost, and priority 2 strategies are in between. Some strategies are categorized as 'supporting strategies,' meaning they do not result in direct reductions in energy use but provide beneficial support to other CAP strategies. This plan does not include calculations of GHG savings for supporting strategies.

Each strategy's GHG reduction benefit has been quantified. For the purposes of prioritization, those strategies that demonstrate a calculable GHG reduction benefit of greater than 250 MT CO2e are considered to have a high benefit. Medium benefit strategies are those with a GHG reduction benefit of between 50 and 250 MT CO2e, and those strategies with less than 50 MT CO2e are considered low benefit strategies.

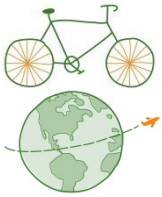
Anticipated upfront costs of implementation are provided for all strategies, including the dollar equivalent of City staff-time and/or actual capital investment needed to implement the strategy. Upfront costs are broadly categorized as falling within one of two ranges: less than $10,000, $10,000 to $50,000, and greater than

$50,000. For example, Strategy E.1.2 is categorized as costing less than $10,000, as it would require minor staff time to implement the strategy and no upfront capital.

Implementation timeframes were also predicted for all strategies. Each strategy was provided a year of expected timeframe to start implementation, with near-term strategies beginning in 2014 and/or 2015, medium-term strategies by 2016 and/or 2017, and long-term strategies after 2017.

## Energy (E)

Energy is an essential part of our daily lives, used for a variety of things including the lighting of buildings and outdoor spaces, heating homes, and powering equipment at homes and businesses. The energy sector, which comprises all electricity and natural gas usage in the City of Hughson, is the second-largest contributor to citywide emissions, representing 41.4 percent of the projected 2020 BAU emissions. GHG emissions from stationary combustion (industrial sources) account for another 14% of 2020 BAU emissions. Energy-related reduction strategies in this chapter target efficiency improvements in the commercial/industrial, residential, and municipal sectors, and the expansion of onsite renewable energy generation. In addition, the City of Hughson is reducing future energy-related emissions through implementation of green building codes and ordinances. Expanded public outreach to support energy efficiency and renewable energy projects is also important. Energy strategies account for 1,813 MT CO2e in avoided GHG emissions, or approximately 54 percent of the estimated reductions from locally implemented strategies.



## Transportation and Land Use (TLU)

The transportation and land use sector accounts for emissions associated with the development patterns of the City and the mobility behavior of its residents. Transportation is the largest contributor to forecasted citywide emissions, representing about 43.6 percent of the 2020 BAU emissions. Strategies for emissions reduction include pursuing sustainable growth patterns with higher density and infill development, as described in the Hughson General Plan (adopted in 2005), as well as reducing single-occupancy vehicle travel and improving non-motorized mobility. Reducing the number of vehicle miles travelled through promotion of alternative transportation will not only reduce GHG emissions but also improve air quality and public health. Transportation and land use strategies account for a reduction of 1,333 MT CO2e, or approximately 40 percent of the estimated reductions from locally implemented strategies.

## Solid Waste (SW)

The transport and disposal of solid waste is expected to account for about 1.0 percent of citywide BAU missions in 2020. Disposing of used products packaging, and waste creates GHG emissions when it is buried in landfills and emits GHG emissions during decomposition. Strategies for emissions reduction include substantially reducing solid waste sent to the landfill by increased recycling. Strategies for this sector account for a reduction of 96 MT CO2e, or approximately 2.9 percent of the estimated reductions from locally implemented strategies.

## Water (W)

GHG emissions associated with the transport of water account for 1.3 percent of citywide BAU missions in 2020. Water is pumped from local groundwater sources, requiring electricity for delivery to its ultimate destination. Strategies to reduce water consumption have important local co-benefits to local water supply and facilitate water conservation goals established by the State and by the City of Hughson Urban Water

Management Plan (UWMP). Reducing water consumption in accordance with the UWMP (20% reduction by 2020) will contribute approximately 89 MT CO2e in annual GHG reductions, or approximatley2.7% of the estimated reductions from locally implemented strategies.

## Municipal Commitment

As explained in Chapter 3, GHG emissions associated with municipal operations are included within the scope of the community-wide inventory. For example, vehicular use for government operations is a subset of the community-wide vehicle miles traveled (VMT), municipal building energy use is included in the community-wide non-residential electrical and natural gas usage, and solid waste generation at the municipal level is incorporated into the generation rate for Hughson as a whole.

With respect to reduction strategies, municipal operations are considered in the context of community-wide strategies. Regardless, the City government will take a leadership role by taking specific steps to reduce emissions associated with its operations. For each of the Energy, Transportation and Land Use, Solid Waste, and Water sectors described below, strategies applicable to municipal operations or activities are presented. In most cases, GHG reductions achieved through a community-oriented strategy would also reduce emissions from municipal operations. Nonetheless, the City is committed to directly reducing its own GHG emissions.

# Energy Goals and Strategies

- 2020 Business-as-Usual GHG Emissions: 13,352 MT CO2e (excluding industrial sources)
- Annual GHG emissions reductions by 2020: 1,813 MT CO2e

Emissions associated with consumption of electricity and natural gas account for approximately 41 percent of the City's 2020 BAU GHG emissions projection. Approximately half of this is associated with commercial buildings and industrial use, while the remainder is associated with residential buildings. Municipal operations, including the energy used for street lighting and traffic lights, contribute a small fraction (approximately 1.6 percent) of total energy use.

For buildings, the amount of energy consumed and the resultant GHG emissions are generally related to building size and type, age of building, building materials, and construction, with considerable efficiencies associated with denser and more compact development. Nationwide, single-family detached homes consume twice the energy of multi-unit dwellings, and individuals living in single family homes consume about one and a half times as much as those living in multi-unit dwellings, on average. Typically, the best strategies for reducing energy-related emissions start with conservation (reducing demand) and energy efficiency, followed by assessing the opportunities to add renewable energy generation capacity.

Examples of energy efficiency and conservation programs include requirements or incentives for "green building" and energy efficient development. New state building standards now require highly efficient new construction. Renewable sources of energy are becoming more available and affordable through rebates, tax incentives and technological advances.

## Energy Providers

In the effort to reduce statewide GHG emissions, the State of California has enacted one of the most ambitious renewable energy standards in the country. The California Renewables Portfolio Standard (RPS) seeks to reduce the proportion of fossil fuel-based electricity generation, and increase the amount of clean, low-emission renewable energy to the power grid. Under California Senate Bill 1028 and Senate Bill 107, and

expanded under Senate Bill 2 in 2011, the RPS program requires investor-owned utilities, electric service providers, and community choice aggregators to increase their use of renewable energy resources by up to 33 percent of procurement by 2020.

Turlock Irrigation District (TID) serves as the City's electricity utility. The way electricity is generated has a significant impact on the City's GHG emissions. In 2010, TID's overall electric power mix was comprised of 48 percent natural gas, 0.2 percent nuclear, 21.3 percent RPS-compliant renewable sources, 24 percent large hydroelectric, and 7 percent coal.[13] With 21.3 percent of electricity coming from RPS-compliant renewable sources, TID is on track to exceed the 33.3% RPS requirement for 2020. TID has developed its renewable energy portfolio through a diverse mix of projects and policies, including the large-scale Tuolumne Wind Project (powering nearly three quarters of TID's 2010 RPS mix), a geothermal plant, and distributed rooftop solar.

Pacific Gas and Electric (PG&E) Company serves as the City's primary natural gas utility, providing natural gas for residential, commercial, industrial, and government customers.

## Energy Reduction Strategies

The vast majority of electricity and natural gas-related GHG emissions in the City are related to residential and commercial buildings. Following California's clean energy policy, which prioritizes energy efficiency in the state's quest to meet energy demand[14], this CAP seeks first to reduce energy demand and maximize energy efficiency, and then to expand new sources of renewable electricity to meet a portion of the remaining demand. **Table 4-2** summarizes the Climate Action Plan's energy strategies and their estimated GHG reduction impact.

Table 4-2
Summary Table of GHG Reduction Impacts for Energy Strategies in 2020

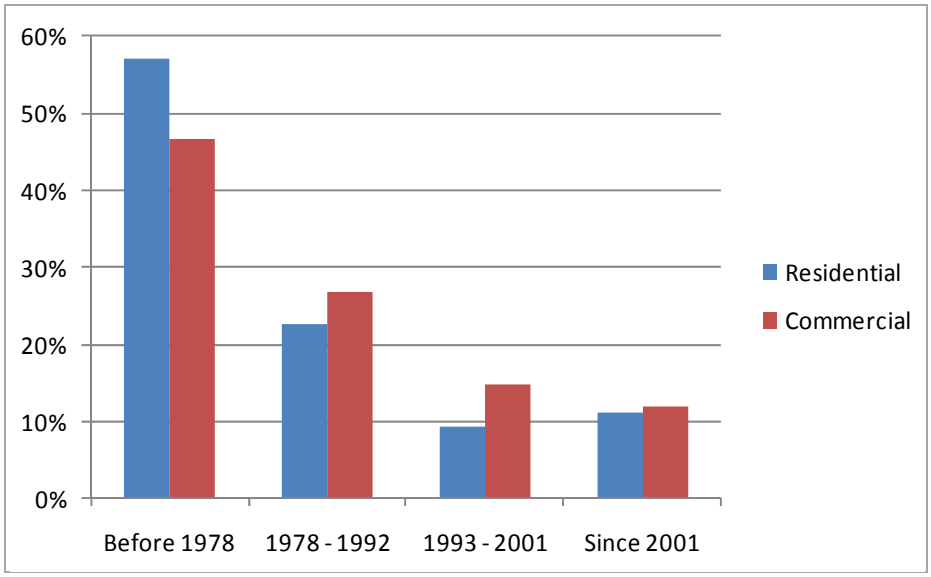
| | Goal/Supporting Strategy | Annual GHG Reduction Potential (MT CO2e) | Priority | First Year of Implementation | Percent of Reduction Category |
|---|---|---|---|---|---|
| E.1 Increase Building and Equipment Efficiency Community-Wide | | | | | |
| E.1.1 | Residential Green Building Standards | 446 | 1 | 2014 | 24.6% |
| E.1.2 | Residential Energy Efficiency Promotion | 128 | 1 | 2014 | 7.1% |
| E.1.3 | Commercial Energy Efficiency Promotion | 543 | 1 | 2014 | 30.0% |
| E.1.4 | Use of Smart Meters | 11 | 2 | 2014 | 0.6% |
| E.1.5 | Industrial Equipment Energy Efficiency Promotion | 100 | 2 | 2015 | 5.5% |
| E.1.6 | Shade Trees | 242 | 1 | 2015 | 13.4% |
| E.2 Increase Renewable Energy Generation and Use Community-Wide | | | | | |
| E.2.1 | On-Site Renewable Energy for Homes | 307 | 2 | 2015 | 16.9% |
| E.2.2 | On-Site Renewable Energy for Commercial and Industrial Users | 23 | 3 | 2015 | 1.3% |
| E.2.3 | Regional Renewable Energy Partnerships | N/A | 3 | 2016 | 0.0% |
| E.3 Improve Municipal Operations Energy Efficiency and Renewable Energy Generation | | | | | |
| E.3.1 | Increase Municipal Energy Efficiency | 12 | 3 | 2015 | 0.7% |
| E.3.2 | Increase Municipal Renewable Energy | N/A | 2 | 2015 | 0.0% |
| | **SECTOR TOTAL** | **1,813** | | | **100%** |

# Goal E.1 Increase Building and Equipment Efficiency Community-Wide

Buildings comprise the largest source of demand for community electricity and natural gas usage. The major factors determining building energy demand are the size and type of building, age of building, and occupancy characteristics. Increasing the energy efficiency of existing homes and buildings can have a significant, ongoing impact on overall energy consumption.

Prior to 1978, there were no energy codes for buildings. Therefore, the greatest opportunities for improving energy efficiency are typically found in the oldest buildings. Starting in 1978, the State of California adopted Title 24, Part 6 of the California Code of Regulations for Energy Efficiency Standards for Residential and Nonresidential buildings. Title 24 code is typically updated every 2 to 4 years. For example, the majority of buildings in PG&E's overall territory were built before Title 24 was enacted, or during the early years of the building energy codes.

Figure 4-1
Distribution of Building Construction Date, by Building Type for PG&E Territory




Significant reductions in building energy demand can be achieved using construction techniques that increase energy efficiency. Efficiency improvements for buildings can be accomplished by:

- Enforcing the state building code (Title 24) for energy efficiency in local construction, as it is updated;
- Going beyond Title 24 requirements for energy efficiency in local construction;
- Incentivizing green building practices by streamlining permitting and other City processes;
- Leveraging existing utility efficiency incentives and other programs;
- Supporting the rollout of smart meter technology;
- Improving industrial factory equipment energy efficiency; and
- Establishing a shade tree program.

# Strategy E.1.1: Residential Green Building Standards.

## Expand green building and energy efficient design for new development.

| | |
|---|---|
| Priority: | 1 |
| Timeframe to start implementation: | Near-Term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 446 |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Lower energy demand, lower energy bills, higher home values. |

**Action E-1.1a:** Revise the City of Hughson Municipal Code to require implementation of CalGreen Tier 1 building code standards for all new residential development.

**Action E-1.1b:** Expedite permits for developments that exceed Title 24 requirements by 15%.

The State of California regulates energy consumption under Title 24 of the California Code of Regulations. Strategy E.1.1 assumes that all new residential project development would be required to adhere to 15% above existing (Year 2008) Title 24 standards for energy efficiency, which is equivalent to the CalGreen Tier 1 standard.

The current Title 24 Building Energy Efficiency Standards (CalGREEN), developed by the California Energy Commission (CEC), promote efficiency in new construction by reducing energy consumed for heating, cooling, ventilation, water heating, and lighting in new residential and non-residential buildings. The CEC updates Title 24 periodically; Assembly Bill 970, signed September 2000, requires the CEC to update and implement its appliance and building efficiency standards to make "maximum feasible" reduction in unnecessary energy consumption. The 2008 Standards became effective statewide on January 1, 2010, and 2013 Title 24 update becomes effective on January 1, 2014. In addition to enforcing the 2013 Title 24 update for commercial buildings, the City will revise the City Municipal Code to require implementation of CalGreen Tier 1 building code standards for all new residential development. Tier 1 implementation requires going 15% beyond the minimum energy efficiency requirements of Title 24.

In addition, the Hughson Community Development Department will expedite permit approval of proposed development projects that meet Tier 1 standards.

The Community Development Department staff will determine the appropriate method of expedition. Possible methods could include:

- Reduced fees or fee waivers for "green" permit applications; or
- Priority permit processing.

# Strategy E.1.2: Residential Energy Efficiency Promotion.

## Promote various federal, State, local, and utility programs and other opportunities to improve the energy efficiency of residential homes.

| | |
|---|---|
| Priority: | 1 |
| Timeframe to start implementation: | Near-Term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 128 |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Lower energy demand, lower energy bills, higher home values |

**Action E-1.2a:** Promote existing residential energy efficiency programs.

**Action E-1.2b:** Promote rebates for residential fixtures and appliances and other utility programs to improve energy efficiency in residential homes.

**Action E-1.2c:** Develop a low-cost local education campaign to promote residential energy efficiency improvements.

**Action E-1.2d:** Participate in a residential Property Assessed Clean Energy (PACE) Program.

**Action E-1.2e:** Continue to participate in the San Joaquin Valley Clean Energy Partnership and the Northern Central Valley Energy Improvement Joint Powers Authority to apply for available Federal grant funding for residential energy efficiency projects.

The California Public Utilities Commission has set an ambitious goal to reduce energy use in existing homes by 40% and install low-energy heating and cooling systems in 50% of new and existing homes by 2020.[15]

One simple but effective way to promote energy efficiency in existing buildings is to make residents aware of the various programs available that reduce the up-front cost of energy-efficiency retrofits. The City will strive to promote various Federal, State, local, and utility residential energy efficiency programs.

A variety of programs exist to encourage homeowners and renters to upgrade their homes with energy-efficient technology. For example, residents can apply for TID rebates on heating, ventilation, and air conditioning (HVAC) equipment, lighting, insulation, cool roofs, energy-efficient appliances, low-income weatherization, and other energy efficiency upgrades. A sampling of currently applicable programs includes:

- *Energy Upgrade California Program:* This program offers incentives to homeowners who complete select energy-saving home improvements on a single-family residence. These incentive packages combine several related improvements at once to increase a home's overall energy efficiency and achieve greater savings. By working with participating contractors, homeowners can choose from two incentive options, the Basic Upgrade Package or the Advanced Upgrade Package, based on their improvement needs and budget.
- *TID Home Rebates:* TID also offers rebates for home improvements projects, including attic insulation, whole house fans, window replacements, and other measures.
- *Appliance Rebates:* TID and PG&E offer rebates for purchases of qualifying refrigerator, washers, dishwashers, room air conditioners, and water heaters

In addition to rebates, residents can take advantage of tax credits, such as the federal 30 percent tax credit on efficiency upgrades, up to $500. Rebates and credits make energy efficiency attractive because they reduce

the payback period, after which the renter/owner starts saving money they would have otherwise spent on energy. This tax credit is currently scheduled to remain available through to the end of 2013.[16]

Further, the City will promote energy benchmarking for all City residents. Energy benchmarking means tracking a building's energy and water use and using a standard metric to compare the building's performance against past performance and other buildings of similar size and type. The EPA Portfolio Manager[17] benchmarking tool can be used free of charge to assess a building's energy performance, water efficiency, and carbon emissions. The City will expand awareness of the program to the majority of City residents by 2019.

Under this strategy, the City of Hughson, through coordination and work-sharing with other agencies, will actively promote these programs and incentives with a local, low-cost education campaign, thereby increasing awareness of them. The Community Development Department staff could promote the program to local residents through a flyer, mail insert, or posting at public locations and during public events. Staff time will be focused on distributing materials, discussing the program with interested parties, and directing interested parties to available resources.

A Property Assessed Clean Energy (PACE) program is a financing tool used by local governments to provide residential and commercial property owners with funds for energy efficiency improvements and retrofits, or for renewable energy systems (e.g., solar panels and small wind turbines). PACE funds may also be used for water-savings measures. Property owners receive 100% financing, and then repay the cost of the improvements as a property tax assessment over the course of 20 years. PACE programs provide significant advantages by eliminating upfront costs, providing low-cost long-term financing and making it easy for building owners to transfer repayment obligations to a new owner upon the building's sale.

The HERO Program (for PACE financing) has been very successful in Western Riverside County, since its launch in late 2011; the Program has approved over $130 million in applications and has funded over $30 million in projects. Because of its success, the California HERO Program is now being offered to provide additional California cities and counties with a turnkey program that saves significant time, cost and local resources that would otherwise be needed to develop a new local program. The City Hughson will consider joining the HERO program, or one that is similar. More information is available at https://www.heroprogram.com/.

The City will also continue to participate in the San Joaquin Valley Clean Energy Partnership and the Northern Central Valley Energy Improvement Joint Powers Authority to apply for available Federal grant funding for residential energy efficiency projects.

## Strategy E.1.3: Commercial Energy Efficiency Promotion.

Promote various federal, State, local and utility programs and other opportunities to improve the energy efficiency of commercial buildings.

| | |
|---|---|
| Priority: | 1 |
| Timeframe to start implementation: | Near-Term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 543 |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Lower commercial building energy demand and energy bills. |

**Action E-1.3a:** Promote rebates for commercial fixtures and appliances and other utility programs to improve energy efficiency in commercial buildings.

**Action E-1.3b:** Develop a low-cost local education campaign to promote benchmarking and cost-effective commercial energy efficiency improvements.

**Action E-1.3c:** Participate in a commercial Property Assessed Clean Energy (PACE) Program.

**Action E-1.3d:** Continue to participate in the San Joaquin Valley Clean Energy Partnership and the Northern Central Valley Energy Improvement Joint Powers Authority to apply for available Federal grant funding for non-residential energy efficiency projects.

Under this strategy, the City will strive to promote PG&E and TID energy efficiency and TID demand response programs for non-residential buildings. Additionally, the City will encourage all businesses to do simple energy benchmarking, using free publically available tools.

In 2005, commercial and industrial building energy consumption in Hughson made up about 41 percent of all community emissions.[18] Overall energy consumption and GHG emissions could be substantially reduced if businesses were more aware of available financial incentives for saving energy. Hughson's electric utilities provide hefty rebates and energy efficiency programs that can provide cost savings to the City's commercial and industrial sectors, through up-front rebates and a payback in energy savings over time. These rebates are meant to incentivize actions that reduce energy demand and associated GHG emissions, and increase awareness of the variable pricing of energy throughout the day.

As described under Strategy E.1.2, A Property Assessed Clean Energy (PACE) program is a financing tool used by local governments that can provide commercial property owners with funds for energy efficiency improvements and retrofits. The HERO Program (for PACE financing) has been very successful in Western Riverside County, since its launch in late 2011; the Program has approved over $130 million in applications and has funded over $30 million in projects. Because of its success, the California HERO Program is now being offered to provide additional California cities and counties with a turnkey program that saves significant time, cost and local resources that would otherwise be needed to develop a new local program. The City Hughson will consider joining the HERO program, or one that is similar. More information is available at https://www.heroprogram.com/.

Additionally, in tandem with Strategy E.1.2, the City will actively promote these programs and incentives with a local, low-cost education campaign that encourages energy audits, use of building insulation, use of energy efficient appliances, and other programs that save energy. The City will also continue to participate in the San Joaquin Valley Clean Energy Partnership and the Northern Central Valley Energy Improvement Joint Powers Authority to apply for available Federal grant funding for residential energy efficiency projects.

### Energy Efficiency Rebates

PG&E and TID offer an extensive array of rebates for commercial energy efficiency improvements, including:

- turning off all non-essential lighting (including that for decorative features);
- insulating buildings and sealing building envelopes;
- pre-cooling working areas or facilities;
- hot water heater and boiler insulation;
- power management software for desktop computers;
- combination ovens and freezers for food service enterprises;

- electric ventilation control and other HVAC improvements; and
- more efficient lighting and signage.

### Commercial Energy Efficiency Tax Credits

Pursuant to the Energy Policy Act of 2005, businesses may qualify for a federal tax credit on a square-foot basis. Owners or tenant business are eligible for the credit if a licensed contractor or engineer verifies lighting power density and/or verifies through energy modeling that the portion of the building being submitted for the tax credit is 25%-50% better than ASHRAE 90.1-2001 standards.

## Strategy E.1.4: Use of Smart Meters.

Support TID efforts to implement smart meters within the community to decrease energy use.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Near-Term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 11 |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time and material costs) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Lower energy demand, greater awareness of energy consumption patterns. |

**Action E-1.4a:** Provide educational materials to residents and businesses on smart meter programs administered through TID and PG&E.

Smart meters are a significant technological advance in modernizing the electric grid. By providing real-time feedback on energy consumption to energy providers, the program allows a much more efficient allocation of energy resources throughout the regional grid. Additionally, smart meters also provide consumers with access to real-time information about their individual electricity consumption, which has been shown to reduce household and business electricity consumption by an average of 2-5 percent. [19] TID has been successfully rolling out smart meters to residents throughout their territory. TID expects to install smart meters at over 85% of their accounts by the end of year 2014.[20] To promote awareness of the program, the City will strive to provide educational materials to residents and businesses on the benefits of smart meter technology and how citizens can best take advantage of them, which include the ability to track detailed personal energy consumption patterns.

# Strategy E.1.5: Industrial Equipment Energy Efficiency Promotion.

## Promote understanding of San Joaquin Valley Air Pollution Control District Industrial Equipment Energy Efficiency Best Performance Standards

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Near-Term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 100 |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Lower energy demand |

**Action E-1.5a:** Make information available regarding the San Joaquin Valley Air Pollution Control District Best Performance Standards for industrial energy efficiency.

The SJVAPCD has developed Best Performance Standards (BPSs) that provide guidelines for improving the energy efficiency of point-source emissions, including boilers, industrial (manufacturing) equipment, and off-road vehicles.[21] Although industrial stationary source emissions are generally not under the influence of the City of Hughson, the City often serves as the lead agency in the context of the California Environmental Quality Act (CEQA) for new development projects that include these sources. In these cases, in which the City has discretion, it shall require conformance with SJVAPCD BPSs to improve energy efficiency and reduce GHG emissions.

Further, the City of Hughson Community Development Department will strive to reach out to owners and operators of large industrial facilities within the City boundaries. Potential owners and operators include those involved in the local dairy industry. This action will help the City to understand what these facilities are doing to reduce energy use and what the City can do to assist and encourage progress. The City will coordinate with these large industrial producers to identify additional sustainability commitments and opportunities for cooperation on renewable energy. The City will also make information available regarding the San Joaquin Valley Air Pollution Control District Best Performance Standards that could include: increasing the efficiency of boilers installed for agricultural uses to provide thermal efficiency of 85-89%; promoting the use of electric motors instead of internal combustion engines; and providing new reciprocating engines to achieve an operating efficiency of 60% or greater.

## Strategy E.1.6: Shade Trees.

Increase shade trees in Hughson to cool buildings and pavement in the summer, which decreases energy use and reduces the "heat island effect" within the City.

| | |
|---|---|
| Priority: | 1 |
| Timeframe to start implementation: | Near-Term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 242 |
| Estimated Annual Cost to the City in 2020: | Medium (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Lower energy demand |

**Action E-1.6a:** Continue to support and promote Turlock Irrigation District's Shade Tree Program by providing brochures on the specifics of the program and including information on the City's website.

**Action E-1.6b:** Complete preparation of and adopt an Urban Forest Plan to manage the urban forest in the City by maintaining and preserving existing trees and planting additional ones.

**Action E-1.6c:** Continue to implement City Codes and ordinances that require planting of new trees, protection of existing trees, and replacement of trees that are removed.

**Action E-1.6d:** Continue to implement landscaping requirements for commercial uses that require planting of new trees and other vegetation (i.e., shrubs, groundcover) of certain size.

The "heat island effect" describes the warming of asphalt, concrete and the built environment to higher temperatures than temperatures in surrounding open space and rural areas. In the summertime, heat islands retain heat and radiate that heat long after the sun goes down, increasing the energy needed to cool buildings later in the evening. Shading can effectively reduce the heat island effect by keeping streets, parking lots, and individual buildings out of direct sunlight, thus, reducing the need for air conditioning and reducing the GHG emissions associated that that energy demand. Further, grid energy supplied during the hottest parts of the day is typically the most expensive, most carbon-intensive energy supplied by utilities as they tend to utilize their older and least efficient power plants at such times, or import power from states where coal-fired power plants are more prevalent.

The City of Hughson will continue to support and promote TID's Shade Tree Program by providing brochures on the specifics of the program and including information on the City's website. The City will also complete preparation of and adopt an Urban Forest Plan to manage the urban forest in the City by maintaining and preserving existing trees and planting additional ones. Additional actions to implement Strategy E.1.6 include continuing to implement City Codes and ordinances that require planting of new trees, protection of existing trees, and replacement of trees that are removed, and continuing to implement landscaping requirements for commercial uses that require planting of new trees and other vegetation (i.e. shrubs, groundcover) of a certain size.

These actions will result in more trees that will shade buildings and pavement, which in turn will lower overall energy demand related to building cooling, and provide additional benefits by increasing carbon-storage biomass. This strategy will build on the CalGREEN requirements. CalGREEN covers residential and commercial buildings, provides 52 nonresidential mandatory measures and an additional 130 provisions for optional use.

There are several voluntary measures that relate to heat island mitigation, including shading, cool pavement, and cool roof technologies.

## Goal E.2 Increase Renewable Energy Generation and Use Community-Wide

Renewable energy is energy from natural sources such as sunlight, wind, geothermal heat, and biomass. The use of renewable energy sources instead of fossil fuels substantially reduces GHG emissions. The City of Hughson has opportunities to supplement or offset grid-supplied electricity with renewable energy that is generated in close proximity to the load being served. Non-grid renewable electricity generation can be implemented at the building scale (i.e. rooftop solar) or at the municipal and/or regional scale, through cooperation among businesses, jurisdictions, and other organizations.

## Solar Energy

Solar energy is a cost-effective source of renewable energy for the residents and businesses of Hughson. According to the National Renewable Energy Laboratory (NREL), more energy from the sun falls on the earth in one hour than is used by everyone on the planet in one year. Although solar photovoltaic (PV) systems will never be 100% efficient in capturing the sun's energy, technological improvements in this area are ongoing; meanwhile, there are a variety of other available approaches and technologies that can efficiently convert sunlight to usable energy for buildings. The most commonly used solar technologies for homes and businesses, other than solar PV, include solar water heating and passive solar design for space heating and cooling. Solar PV and concentrating solar power technologies are also being used by developers and utilities to produce electricity on a massive scale to power cities and small towns.[22]

One key benefit of solar energy is that its peak resource availability corresponds to peak system loads for conventional electricity. Therefore, solar energy systems have the potential to offset electricity usage when it is the most expensive – and typically the most carbon-intensive – as older, less efficient power plants are brought online to meet peak loads.

## Wind Energy

NREL indicates that the average wind energy potential for the City of Hughson is not considered suitable for cost-effective wind energy development. Areas with annual average wind speeds around 6.5 meters/second and greater at an 80-m height are generally considered to have a resource suitable for wind development. NREL's wind resource map shows that the City of Hughson is located in an area with wind speeds between 4.0 and 5.5 meters/second.[23] Therefore, wind energy is not considered further as a viable source of renewable energy in Hughson.

# Strategy E.2.1: On-Site Renewable Energy for Homes.

## Increase on-site renewable energy generation and use in homes.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Near-Term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 307 |
| Estimated Annual Cost to the City in 2020: | Medium (some City staff and City Council time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Lower energy bills, lower operating costs for commercial and industrial users, increased energy independence, additional jobs, and increased home values. |

**Action E-2.1a:** Implement local ordinances and expedited permitting processes to support renewable energy in new residential uses.

**Action E-2.1b:** Participate in a commercial Property Assessed Clean Energy (PACE) Program.

**Action E-2.1c:** Strive to promote existing financial incentives for renewable energy system installations.

On-site renewable energy systems represent an effective strategy for reducing emissions. Generally, renewable energy systems should be installed only after implementing all cost-effective efficiency measures. The best options for Hughson businesses and residents are solar hot water heating and roof-top PV systems.

The largest barriers to expanding on-site renewable energy are access to information, high up-front financing costs and long cost-recovery periods. Therefore, under this strategy, the City of Hughson Community Development staff, in work-sharing agreements with other jurisdictions, will strive to disseminate renewable energy information and promote existing financial incentives for solar PV and hot water system installation, some of which are described below. Beyond promotion of existing financial incentives for renewable energy system installations, the City of Hughson will implement local ordinances and expedited permitting processes to support renewable energy in new residential uses. Section 17.03.012 of the City's Zoning Code promotes and encourages the use of alternate energy by protecting solar and wind access of buildings. The City will work to expedite permits associated with the installation of renewable energy facilities.

A Property Assessed Clean Energy (PACE) program is a financing tool used by local governments that can provide residential and commercial property owners with funds for energy efficiency improvements and retrofits, or for renewable energy systems (e.g., solar panels and small wind turbines). Property owners receive 100% financing, and then repay the cost of the improvements as a property tax assessment over the course of 20 years. PACE programs provide significant advantages by eliminating upfront costs, providing low-cost long-term financing and making it easy for building owners to transfer repayment obligations to a new owner upon the building's sale. The HERO Program (for PACE financing) has been very successful in Western Riverside County, since its launch in late 2011; the Program has approved over $130 million in applications and has funded over $30 million in projects. Because of its success, the California HERO Program is now being offered to provide additional California cities and counties with a turnkey program that saves significant time, cost and local resources that would otherwise be needed to develop a new local program. The City Hughson will join the HERO program, or one that is similar, for financing renewable energy systems. The city will also explore promoting the program regionally with other jurisdictions in Stanislaus County. More information is available at https://www.heroprogram.com/.

### Rebates and Tax Credits for Existing Owners:

TID offers cash rebates for both PV systems and solar water heating systems on single-family homes in TID service areas, through their Solar Rebate Program[24] rebates. Multifamily properties also qualify for rebates, and there are targeted programs for installing solar on affordable housing buildings. Rebates vary depending on the type of solar water heating system, location, shading and other design factors. After installation, TID can purchase power from customers with eligible renewable generation up to 1 MW in size.[25] To participate, customers and TID both sign a standard power purchase agreement (PPA) and the customer must arrange to connect to the grid.

### Incentives for Developers:

The California Energy Commission's New Solar Homes Partnership (NSHP) is part of the comprehensive statewide solar program, known as the California Solar Initiative. The NSHP provides financial incentives and other support to home builders, encouraging the construction of new, energy efficient solar homes that save homeowners money on their electric bills and protect the environment. Under this strategy, Hughson would promote this program to developers seeking permits or other approvals from the City.

## Strategy E.2.2: On-Site Renewable Energy for Commercial and Industrial Users.

Increase on-site renewable energy generation and use in commercial and industrial uses.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Near-Term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 23 |
| Estimated Annual Cost to the City in 2020: | Medium (some City staff and City Council time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Lower energy bills, lower operating costs for commercial and industrial users, increased energy independence, additional jobs, and increased building values. |

**Action E-2.2a:** Implement local ordinances and expedited permitting processes to support renewable energy and increase the installation rate of solar water heating and/or roof-top photovoltaic systems.

**Action E-2.2b:** Participate in a commercial Property Assessed Clean Energy (PACE) Program.

**Action E-2.2b:** Promote existing financial incentives for renewable energy systems such as the Turlock Irrigation District Solar Rebate Program rebates and Federal Tax Credits for non-residential units.

The development of on-site renewable energy for commercial and industrial buildings could substantially reduce the City's community GHG emissions. This strategy would work in tandem with improving commercial and industrial building efficiency.

As described under Strategy E.2.1, a Property Assessed Clean Energy (PACE) program is a financing tool used by local governments that can provide commercial property owners with funds for energy efficiency

improvements and retrofits, or for renewable energy systems (e.g., solar panels and small wind turbines). The City Hughson will join the HERO Program (for PACE financing), or one that is similar, for financing commercial renewable energy systems. More information is available at https://www.heroprogram.com/.

The City will promote on-site renewable energy for local businesses and industry by developing and distributing guidelines, informational brochures, and promote existing financial incentives (for example, TID Solar Rebate Program rebates and Federal Tax Credits for non-residential units). In line with Strategy E.2.1 (On-site Renewable Energy for Homes), the City will also implement local ordinances, Section 17.03.012 of the Hughson Municipal Code, and expedited permitting processes to support renewable energy and increase the installation rate of solar water heating and/or roof-top photovoltaic systems.

## Strategy E.2.3: Regional Renewable Energy Partnerships.

### Continue regional partnerships to implement and fund more cost effective renewable energy systems through economies-of-scale.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Medium-term (2016) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | N/A (supporting measure) |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Increased energy independence for the community. |

**Action E-2.3a:** Consider developing a community choice aggregation (CCA) agreement with TID to allow purchase of electricity from more energy efficient third parties.

**Action E-2.3b:** Continue to participate as part of the Northern Central Valley Energy Improvement Joint Powers Authority to apply for grants, as well as to implement, fund, and finance energy conservation and renewable energy projects and programs for residential uses.

Regional initiatives to promote shared renewable energy can help drive down start-up costs for individuals or smaller organizations by providing economies of scale, and provide community and regional control of energy resources. The City of Hughson will continue to work with regional partnerships, including the San Joaquin Valley Clean Energy Organization (SJVCEO), the Northern Central Valley Energy Improvement Joint Powers Authority, neighboring cities, and other organizations, to explore strategies for developing renewable energy resources (including grant monies) that can benefit Hughson's citizens as well as the wider region as a whole.

The City will consider developing a CCA agreement with TID to allow purchase of electricity from more energy efficient third parties. A CCA is a State-sanctioned system that allows cities and counties to aggregate the buying power of energy customers in order to secure alternative energy supply contracts, which could include renewable energy. Adopting CCA would mean the City would be the City's electric utility and would purchase wholesale electricity from any provider, which could include TID. Due to the uncertainty of implementation, no GHG reductions are currently associated with this strategy.

# Goal E.3 Increase Energy Efficiency and Renewable Energy Generation and Use in Municipal Operations

The City of Hughson will take steps to increase the energy efficiency and renewable energy generation of municipal operations, setting an example and providing leadership to the overall community.

## Strategy E.3.1: Municipal Energy Efficiency.

### Increase energy efficiency in government operations, including City buildings and facilities.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Near-term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 12 |
| Estimated Annual Cost to the City in 2020: | Medium (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Act as a model for the community-at-large. |

**Action E-3.1a:** Continue to apply for grants to retrofit all City buildings and facilities with more energy efficient lighting systems, appliances, traffic signals, and streetlights.

The City of Hughson will continue to seek out energy-efficiency rebates to offset the costs of government operations and promote recognition of its energy sustainability efforts. The City will apply for grants to retrofit all City buildings and facilities with more energy efficient lighting systems, traffic signals, and streetlights.

The City of Hughson received a grant in 2011 to improve the energy efficiency of municipal operations. The City retrofitted the City Hall, Community Senior Center, Corp Yard, and Police Department with energy efficient lighting and occupancy sensors. In addition, the City converted one traffic signal to LED, and six street lights to induction lights. An air conditioning unit was replaced with an energy efficient (Energy Star) commercial unit at the Hughson Community Senior Center. Improvements were made within the 2011/2012 timeframe.

## Strategy E.3.2: Municipal On-site Renewable Energy Sources.

### Increase on-site renewable energy systems at City facilities.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Long term (after 2017) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | None expected |
| Estimated Annual Cost to the City in 2020: | Medium (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Act as a model for the community-at-large. |

**Action E-3.2a:** Where financially viable, Install renewable energy systems such as solar panels at the City's wastewater treatment plant.

The City will increase the proportion of renewable energy used by City operations. The City will explore opportunities for on-site renewable energy to power City operations, and install additional renewable energy systems, where feasible. No installations of on-site renewable energy systems are expected at City facilities by 2020.

# Transportation and Land Use Goals and Strategies

- 2020 Business-as-Usual GHG Emissions: 15,677 MT CO2e
- Annual GHG emissions reductions by 2020: 1,333 MT CO2e

Emissions associated with transportation and land use patterns (14,943 MT CO2e) represent approximately 43.6 percent of the City's 2020 GHG BAU emissions projection. The bulk of these emissions are expected to be generated by vehicles travelling on state highways and City streets. The remainder will be generated by vehicles engaged in off-road activities, like construction, agricultural production, and recreation.

## Reducing Emissions with Transportation and Land Use

To achieve its 2020 reduction target, the City must emphasize strategies that address GHG emissions from land use and transportation, as they are inextricably linked. Existing land use patterns are responsible for the large number of daily vehicular trips generated in Hughson that in turn account for a large proportion of citywide GHG emissions. Existing development patterns and the supporting transportation infrastructure are major factors in the transportation habits of residents because they limit mobility choices, fostering an auto-dependant culture that relies less on walking, biking, and public transit and more on personal daily motor vehicle trips. Public transit facilities and service is somewhat limited in the City, reducing its efficiency and appeal as a viable alternative to driving. In addition, the lack of an extensive and well-connected pedestrian and bicycle system and associated amenities can be a disincentive to choosing non-motorized mobility alternatives. Meanwhile, inefficient single-occupant vehicles and traffic congestion contribute further to tail pipe emissions.

State regulations will require higher fuel efficiency and lower carbon fuels over the next few years. However, state regulations alone will not sufficiently lower VMT and transportation emissions. Effective local strategies for reducing emissions associated with transportation and land use focus on reducing the total VMT and number of vehicle trips required for City residents and businesses (both within, and to and from the City), and on proliferation of more zero- and low-emission vehicles. VMT can be reduced and traffic congestion relieved by gradually changing land use patterns to be more sustainable, improving pedestrian and bicycle infrastructure, and improving public transit options. Alternative vehicle infrastructure can be improved by partnering with regional agencies. Specific approaches considered for the City of Hughson include:

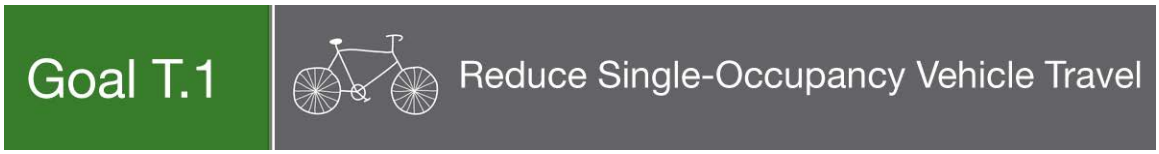
- Create a built environment that allows people to have more transportation choices, including walking, bicycling, or taking public transit, rather than relying solely on single occupancy vehicles (SOVs);
- Encourage higher density, mixed-use development near local-serving commercial areas;
- Encourage the use of lower-emission vehicles, and expand the infrastructure and safety for people to walk or bike;

- Expand alternatives for commuting and local travel, and provide secure bike parking and related amenities for all new development; and
- Continue applying parking reduction policies in the downtown core of the City.

Table 4-3 summarizes the Climate Action Plan's transportation and land use strategies and their estimated GHG reduction impact.

Table 4-3
Summary of GHG Reduction Impacts for Transportation and Land Use Strategies in 2020

| | Goal/Supporting Strategy | Annual GHG Reduction Potential (MT CO2e) | Priority | First Year of Implement-ation | Percent of Category |
|---|---|---|---|---|---|
| T.1 | Reduce Single-Occupancy Vehicle Travel | | | | |
| T.1.1 | Local Commute Trip Reduction | 347 | 1 | 2014 | 26.0% |
| T.1.2 | Regional Transportation Management | N/A | 3 | 2015 | <1% |
| T.1.3 | Parking Management | 44 | 3 | 2014 | 3.3% |
| T.2 | Increase Non-Motorized Travel | | | | |
| T.2.1 | Bicycle and Pedestrian Infrastructure Improvement | 15 | 3 | 2015 | 1.1% |
| T.2.2 | Safe Routes to Schools | 51 | 2 | 2015 | 3.8% |
| T.3 | Improve Public Transit Use | | | | |
| T.3.1 | Public Transit Expansion | 43 | 3 | 2016 | 3.2% |
| T.4 | Increase Motor Vehicle Efficiency | | | | |
| T.4.1 | Fuel Efficient and Alternative Fuel Vehicle Use | 54 | 2 | 2016 | 4.0% |
| T.4.2 | Fuel Efficiency for Municipal Fleet | 20 | 3 | 2014 | 1.5% |
| LU.1 | Promote Sustainable Growth Patterns | | | | |
| LU.1.1 | Sustainable Growth Pattern | 760 | 1 | 2014 | 57.0% |
| LU.2 | Support Locally-Produced Foods | | | | |
| LU.2.1 | Farmer's Markets | N/A | 3 | 2015 | <1% |
| | **SECTOR TOTAL** | **1,333** | | | **100%** |




Nationwide, 27.7 percent of all VMT is attributable to vehicle trips to and from work.[26] Applying that ratio to projected 2020 BAU VMT for Hughson, 16,594,640 annual VMT would be attributable to commuting trips in 2020 for the City.

Trip generation can be reduced by implementing transportation demand management (TDM) strategies for employees in the City that include telecommuting options, alternative work and school schedules, on-site amenities, car and vanpooling programs, and parking reduction strategies. Commute trip reduction programs can encourage use of alternative modes, particularly for commuting to work by employees to local employers.

Parking management strategies limit the supply of parking spaces to help encourage people from traveling alone in vehicles.

## Strategy T.1.1: Local Commute Trip Reduction.

Support local employer-based trip reduction programs consistent with the San Joaquin Valley Air Pollution Control District's Employer Based Trip Reduction Program (Rule 9410) to reduce the number of daily commuter vehicles to and from the City of Hughson.

| | |
|---|---|
| Priority: | 1 |
| Timeframe to start implementation: | Near-term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 347 |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Better local air quality, lower fuel demand, lower fuel costs |

**Action T-1.1a:** Promote SJVAPCD's Employer Trip Reduction Implementation Program Rule 9410 (eTRIP), which requires larger employers to establish a program that encourages employees to reduce single-occupancy vehicle trips.

**Action T-1.1b:** Encourage smaller employers to implement transportation demand management measures to reduce single-occupancy vehicle trips.

The City of Hughson will encourage a compressed work week for local employers, and promote the SJVACPD's Employer Trip Reduction Implementation Program (eTRIP) Rule, which was adopted in December 2009. This encouragement could take the form of public information inserts in the local utility bill, e-mail distribution, and /or through Chamber of Commerce presentations and coordination.

Employers would be encouraged to implement a compressed work week, involving at least one of the following:

- Forty hours spread among four workdays days in one week (4/40)
- Eighty hours spread among nine workdays in two weeks (9/80)
- Telecommuting 1.5 days per week

The SJVACPD eTRIP rule requires larger employers to establish a program that encourages employees to reduce single-occupancy vehicle trips, and it is applicable to employers within the San Joaquin Valley Air basin with at least 100 eligible employees. The rule states that employers must submit an employer trip reduction plan by September 1, 2011, and begin commuter verification submissions by January 1, 2014. Annual reports of the eTRIP and commuter verification are required by 2015, and every year thereafter.

The City will also encourage employers of less than 100 employees to implement transportation demand management measures.

## Strategy T.1.2: Regional Transportation Management.

### Support regional transportation management programs to shift single-occupancy vehicle trips to other modes.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Near-term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | N/A |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Better local air quality. |

**Action T-1.1a:** Continue to coordinate with Stanislaus County and neighboring cities within the County to encourage alternatives to single-occupancy vehicles.

The City of Hughson will support regional transportation management programs to shift single-occupancy vehicle trips to other modes. The City will continue to coordinate with Stanislaus County and neighboring cities within the County to encourage alternatives to single-occupancy vehicles. This Strategy is a supporting strategy; reduction credit for this strategy is not quantified.

## Strategy T.1.3: Parking Management.

### Use parking policies to encourage alternative modes of transportation and discourage single-occupancy vehicle travel.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Near-term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 44 |
| Estimated Annual Cost to the City in 2020: | Low (some City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Better local air quality and community health |

**Action T-1.3a:** Continue to waive off-street parking requirements and reduce parking requirements for retail, office, and restaurant uses for new development in downtown Hughson.

**Action T-1.3b:** Modify City's Zoning Code to allow park and ride lots with a use permit, where necessary, in commercial and industrial zones, as well in other appropriate zones.

Parking management is an effective way to reduce automobile travel and encourage the use of low emitting vehicles. Driving and parking are complementary: you need a parking space at virtually every destination. The City will use parking policies to discourage driving, encourage the use of more fuel-efficient vehicles, and discourage single-occupancy vehicle travel. The City will continue to waive off-street parking requirements and reduce parking requirements for retail, office, and restaurant uses for new development in downtown Hughson.

The Hughson Municipal Code Section 17.03.060 waives off-street parking requirements for first floor of buildings in the downtown core parking area for development within the Hughson downtown, designated in the Hughson General Plan as downtown commercial. Parking requirements are reduced to one space for every 500 square feet of retail and office use, and one space for every 200 square feet of restaurant use in the downtown transitional parking area. Where necessary, the City will also modify the City's Zoning Code to allow park and ride lots in commercial and industrial zones, and in other zones with a use permit. With designated park and ride lots, commuters will be encouraged to carpool.

## Goal T.2 Increase Non-Motorized Travel

A City with enhanced and integrated pedestrian and bicycle facilities encourages residents to drive less often, which results in reduction of VMT. Bicycling can replace a significant share of motorized travel, typically 5-15 percent with good facilities. In addition, increasing the use of non-motorized travel such as walking and biking helps reduce traffic congestion, improves air quality, and promotes a healthy lifestyle.

Conventional transportation impact analysis tends to overlook and undervalue non-motorized transportation modes such as multiple short and non-motorized trips. Non-motorized trips are undercounted because they include off-peak trips, non-work trips, travel by children, recreational travel, and non-motorized links of automobile and public transit trips.[27]

### Strategy T.2.1: Bicycle and Pedestrian Infrastructure Improvement.

Improve bicycle and pedestrian infrastructure within the community to increase non-motorized travel.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Near-term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 15 |
| Estimated Annual Cost to the City in 2020: | High (up-front capital costs and City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Better local air quality and community health. |

**Action T-2.1a:** Install support facilities at City facilities to encourage bicycle use.

**Action T-2.1b:** Encourage new development to install bicycle support facilities such as bicycle racks to promote bicycle use.

**Action T-2.1c:** Continue to implement the Non-Motorized Transportation Plan to improve infrastructure for bicycle and pedestrian travel to encourage their use and complete the gaps in the existing systems.

**Action T-2.1d:** Continue to implement the Sidewalk Infill Program (part of the Non-Motorized Transportation Plan) to improve sidewalks, create continuous pedestrian infrastructure, and increase walking as an alternative form of transportation.

**Action T-2.1e:** Continue to implement the City of Hughson Design Manual for Living Streets, which is consistent with the Complete Streets Act and serves the needs of all transportation users.

Bicycle improvements provide synergistic effects, where the total impacts are greater than the sum of their individual impacts. A single bicycle lane generally provides little benefit because it will connect few destinations, but a network of integrated bicycle lanes and shared travel lanes can be more beneficial because it provides multiple connections between trip origin and trip destinations, thereby attracting a larger population of potential users with more diverse travel patterns. Therefore, it's generally best to implement and evaluate integrated programs.

Improved pedestrian facilities generally consist of improvements to sidewalks and pedestrian crossings at intersections to create a continuous network. A safe and convenient system of pedestrian facilities can encourage walking.

The City will take the following steps to improve City bicycle and pedestrian infrastructure:

- Continue to install support facilities at City facilities to encourage bicycle use. Bicycle support facilities were implemented at City Hall in 2007, and similar actions will be considered at other City facilities.
- Encourage new development to install bicycle support facilities such as bicycle racks to encourage bicycle use.
- Continue to implement the Non-Motorized Transportation Plan to improve infrastructure for bicycle and pedestrian travel to encourage their use and complete the gaps in the existing systems. The Hughson Non-Motorized Transportation Plan was adopted in October 2008. The City receives $100,000 per year in grant funding to implement improvements to non-motorized travel.
- Continue to implement the Sidewalk Infill Program (part of the Non-Motorized Transportation Plan) to improve sidewalks, create continuous pedestrian infrastructure, and increase walking as an alternative form of transportation.

Additionally, the City has recently adopted a City Design Manual for Living Streets. The City will implement the Design Manual, which is consistent with the Complete Streets Act and serves the needs of all transportation users and modes of travel. The goal of the Design Manual is to achieve balanced street design that accommodates cars while ensuring that pedestrians, cyclists and transit users can travel safely and comfortably. This manual also provides guidance on incorporating features to make streets lively, beautiful, economically vibrant as well as environmentally sustainable.

## Strategy T.2.2: Safe Routes to Schools.

### Increase opportunities for schoolchildren to walk and bike to and from school.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Near-Term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 51 |
| Estimated Annual Cost to the City in 2020: | Medium (up-front capital costs and City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Better local air quality and community health. |

**Action T-2.2a:** Implement safety improvements to City pedestrian and bicycle facilities that include striping crosswalks around schools to ensure safe conditions.

**Action T-2.2b:** Support the Hughson Unified School District efforts to encourage and educate parents/students about the benefits of walking and cycling to school.

Safe Routes to School is a national and international movement to create safe, convenient, and fun opportunities for children to bicycle and walk to and from schools. The City will increase opportunities for schoolchildren to walk and bike to and from school by continuing to implement safety improvements to City pedestrian and bicycle facilities. All crosswalks around schools in the City of Hughson have been striped. The City will also support the Hughson Unified School District efforts to encourage and educate parents/students about the benefits of walking and cycling to school.

# Goal T.3 Improve Public Transit Use

Improving public transit can significantly reduce emissions by moving a large number of people efficiently and providing more opportunities for community members to choose low-carbon transportation modes, in place of single-occupancy vehicle use. Improving public transit also has potential Local Co-benefits, including better access to transit (especially for the young, elderly, and disabled), as well as health benefits associated with walking to and from public transit stops.

## Strategy T.3.1: Public Transit Expansion.

### Increase public transit ridership in the community through additional transit facilities and promotion of existing services.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Medium-term (2016) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 43 |
| Estimated Annual Cost to the City in 2020: | Medium (City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Better local air quality. |

**Action T-3.1a:** Continue to promote existing discount transit passes for residents.

**Action T-3.1b:** Support the modified dial-a-ride program operated by the Stanislaus Regional Transit.

**Action T-3.1c:** Require new development to include bus facilities or contribute fees to pay for facilities, where appropriate.

According to the 2000 United States Census, only 0.8 percent of all residents over the age of 16 reported that they ride public transit to get to work. According to CAPCOA, typical suburban developments close to major cities have only a 1.3 percent public mode share.[28]

The City's public transit ridership is limited by the City's small size, rural surroundings, distance from major cities, and relatively low population and development density. Stanislaus County Regional Transit (StaRT) provides regional bus service in Stanislaus County.

Under this strategy, the City will coordinate closely with this agency to explore the feasibility of implementing the following actions:

- Continue to promote existing discount transit passes for residents;
- Support the modified dial-a-ride program operated by Stanislaus Regional Transit; and
- Require new development to include facilities or contribute fees to pay for facilities, where appropriate.

## Goal T.4 Increase Motor Vehicle Efficiency

Increasing motor vehicle efficiency on the community and municipal levels can play a significant role in directly reducing the output GHG emissions by motor vehicles. Over the last 30 years, the fuel economy (miles per gallon, or mpg) of new passenger vehicles in the United States has improved significantly, increasing by more than 30 percent. Until very recently, most of the gains occurred in the early years of fuel economy regulation under the Corporate Average Fuel Economy (CAFE) program. Fuel economy improvements were nearly stagnant from the late 1980s to the early 2000s. Over this period, the technical efficiency (amount of energy needed to move a given vehicle mass) of light-duty vehicles improved, although fuel economy (the amount of gasoline consumed per mile traveled) remained unchanged, as consumer preferences shifted to larger, heavier, and more powerful vehicles. Fuel economy standards for light trucks were increased slightly in 2003, and recent federal vehicle standards adopted in 2010 and 2012 are expected to raise average fuel economy as high as 54.5 mpg for model year 2025.[29]

Beyond improving fuel efficiency in vehicles, another method for reducing GHGs through fuel economy is to switch to electric and hybrid vehicles. A vehicle that operates on electricity only does not emit any tailpipe emissions. A fuel cell vehicle operating on hydrogen emits only water vapor. Plug-in hybrid vehicles that operate on either electricity or gasoline only emit lower tailpipe GHG emissions compared to their gasoline-powered counterparts.

### Strategy T.4.1: Increase Motor Vehicle Efficiency.

Develop infrastructure to support fuel efficient and alternative vehicle use.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Medium-term (2016) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 54 |
| Estimated Annual Cost to the City in 2020: | Medium (City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Better local air quality. |

**Action T-4.1a:** Encourage private development to install electric charging stations and other public infrastructure for biodiesel and other alternative fuel vehicles through permit streamlining.

**Action T-4.1b:** Continue to permit biodiesel service or fueling stations in appropriate zones.

**Action T-4.1c:** Continue to implement a waste cooking oil collection program to provide feedstock for biodiesel fueling stations.

The use of alternative fuels, electric vehicles, and other cleaner forms of transportation will help reduce the amount of GHG emissions generated in Hughson and the atmosphere. To promote fuel efficient and alternative vehicle use, the City will strive to develop infrastructure to support its use. Through permit streamlining the City will encourage private development to install electric charging stations and other public infrastructure for vehicles that use biodiesel and other alternative fuels. Permit streamlining includes reducing fees or providing priority permit processing to ensure a shorter time for permit issuance.

The City will also continue to permit biodiesel service or fueling stations in appropriate zones. Service stations are a permitted use in certain commercial zones (C-2, C-3), and in industrial zones as identified in the Hughson Municipal Code. Service stations are defined as any building, structure, premises or other place used primarily for the retail sale and dispensation of motor fuels, which include biodiesel.

To support alternative fuel use, Hughson will also continue to implement a waste cooking oil collection program to provide feedstock for biodiesel fueling stations. The City currently contracts with its solid waste hauler, Waste Management, Inc., to collect waste oil.

## Strategy T.4.2: Fuel Efficiency for Municipal Fleet.

### Continue to upgrade the City fleet vehicles to include additional electric, hybrid-electric, and alternative fuel vehicles to reduce emissions associated with City operations.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Near-term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 20 |
| Estimated Annual Cost to the City in 2020: | High (Up-front capital cost) |
| Responsibility: | Public Works Department |
| Local Co-benefits: | Better local air quality, lower fuel demand, lower fuel costs |

**Action T-4.2a:** Continue to set aside existing budget and pursue grants to obtain funding in order to replace the City fleet with more fuel efficient and alternative fuel vehicles.

The City will continue to upgrade the City fleet vehicles to include additional electric, hybrid-electric, and alternative fuel vehicles to reduce emissions associated with City operations. Hughson will implement this strategy by continuing to set aside existing budget and by pursuing grant funding to replace the City fleet with more fuel efficient and alternative fuel vehicles. In 2005, 45% of the City's municipal fleet was comprised of vehicles powered by compressed natural gas (CNG). The City has added five electric vehicles since then. The percentage of alternative vehicles in the City's fleet was 64% in 2012.

# Goal LU.1 Promote Sustainable Growth Patterns

Hughson currently has a shortage of employment opportunities for its residents, resulting in an outflow of residents during the day as they travel to jobs in neighboring communities. Retail services are also limited in the City requiring residents to shop in other towns. In order to promote sustainable growth patterns in the future, the Hughson General Plan encourages the development of a diversity of housing types, a wide range of industrial development, and varying types of retail services. A community with housing and transportation choices located near jobs and services is more sustainable and requires less driving. Mixed use, higher-density, or infill development facilitates fewer and shorter car trips by providing more diverse land uses within close proximity of a larger population. These fewer and shorter car trips will reduce total VMT, and associated GHG emissions. According to a study from the National Academy of Sciences (NAS), a private nonprofit chartered by Congress,[30] more compact mixed-use development of residential and employment centers can result in overall GHG reductions of up to 25 percent. The report suggests that such reductions can be accomplished with:

- Smaller lots for detached houses could shorten vehicle trip distances in low-density urban fringes;
- Smaller lots and multiple-unit housing could support public transportation and encourage walking and bicycling in moderate density suburbs; and
- Redevelopment of strategically located underused parcels within proximity of existing services and amenities.

## Strategy LU.1.1: Sustainable Growth Pattern.

### Support higher densities, infill development, and sustainable growth patterns to reduce VMT.

| | |
|---|---|
| Priority: | 1 |
| Timeframe to start implementation: | Near-term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 760 |
| Estimated Annual Cost to the City in 2020: | Medium (City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | Better local air quality and a more connected community. |

**Action LU-1.1a:** Implement the City's Zoning Code that allows for higher densities, infill development, and mixed use that is pedestrian-friendly.

**Action LU-1.1b:** Focus future development within the City limits and its Sphere of Influence to prevent urban sprawl and leapfrog development.

The City will continue to encourage and support higher density, infill, and mixed-use development through implementation of the City's Zoning Code. Residential densities in the City of Hughson meet and exceed the San Joaquin Valley Blueprint recommended densities, and are among the highest in Stanislaus County. The San Joaquin Valley Blueprint is a long-range, multi-jurisdictional vision for smart growth development in the valley. The 2050 growth scenario identified areas of existing development and future transportation

improvements to result in a target density of 6.8 units per acre of new residential growth. Hughson's Zoning Code includes a High Density Residential (R-3) zone that allows up to 27.0 dwelling units per acre, while the General Commercial (C-2) zone allows up to 30.0 dwelling units in the Downtown area as part of mixed-use developments.

Local-serving commercial areas are typically supported by commercial anchors, as well as by their proximity to adjacent residential or employment areas. Increasing residential uses in close proximity to those commercial areas would allow for residents to walk to these services, thereby reducing VMT and associated GHG emissions. The increase in residential uses would be accomplished through introduction of residential uses in currently exclusively commercial areas (mixed-use) such as in the Downtown area, or through increasing residential densities in these areas.

In addition, the City will focus future development within the City limits and its Sphere of Influence to prevent urban sprawl and leapfrog development. The SOI consists of areas closest to the existing City limits and targeted for development before other parts of the SOI. Areas within the SOI are contiguous with existing urban uses where urban services are already available, which allow for the well-planned expansion of services. In 2012, the City adopted an Urban Growth Boundary so that all development will be limited to the Sphere of Influence until the year 2050.

## Goal LU.2 Support Locally-Produced Foods

Locally-produced foods help reduce the life-cycle emissions associated with food transport, while providing more opportunity for community engagement. Although emissions from supporting locally-produced food are not quantified, they City of Hughson will take additional steps to encourage local food producers.

### Strategy LU.2.1: Farmer's Markets.

Support local Farmer's Markets and other venues to sell locally-grown and produced foods in the City to reduce GHG emissions.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Near-term (2015) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | N/A |
| Estimated Annual Cost to the City in 2020: | Medium (City staff time) |
| Responsibility: | Community Development Department |
| Local Co-benefits: | A more connected community, contributes to local economy, supports local agricultural industry |

**Action LU-2.1a:** Continue to allow Farmer's Markets and other venues to sell locally-grown and produced foods in commercial zones, and modify the City's Zoning Code to allow this use in other appropriate zones. Consider a code amendment to allow Farmer's Markets to operate outside of a building.

Foods that are packaged and shipped to other locations outside of the City require more energy than food that is grown and consumed locally. Hughson residents, businesses and visitors can purchase locally-grown and produced foods that are transported a short distance from its source. The City's Zoning Code allows food and beverage sales in all commercial zones. Food and beverage sales is defined as a retail establishment in which the majority of the floor area open to the public is occupied by food or beverage products that are packaged for consumption away from the store.

The City will support local Farmer's Markets and other venues to sell locally-grown and produced foods in the City by continuing to allow Farmer's Markets and other venues to sell locally-grown and produced foods within buildings in commercial zones, and modify the City's Zoning Code to allow this use in other appropriate zones. The City will also consider amending the Zoning Code to allow Farmer's Markets to operate outside of a building.

# Solid Waste Goals and Strategies

- 2020 Business-as-Usual GHG Emissions: 361 MT CO2e
- Annual GHG emissions reductions by 2020: 96 MT CO2e

Emissions associated with the solid waste decomposition at landfill (361 MT CO2e) constitute approximately 1.0 percent of the City's 2020 BAU GHG emissions projection. Diverting solid waste from landfills is an effective way to reduce GHG emissions by avoiding anaerobic decomposition of organic material and recovering the embodied energy in recycled materials. Strategies for reducing the amount of solid waste generated by the community include partnering with the local waste hauler to build on existing diversion programs and incentivizing the community to increase diversion rates.

Waste Management, Inc. provides curbside solid waste collection and disposal and curbside recycling for City of Hughson residents. Curbside collection bins are provided separately for trash, mixed recycling, and green waste. The City is a member of the Stanislaus County Regional Solid Waste Planning Agency (RSWPA), which was formed in 2001 and includes eight cities within the county. As a whole, the RSWPA diverted 64 percent of solid waste from landfills in 2005 and diverted 61 percent in 2006.[31]

## Waste Diversion

Energy is expended in the extraction, processing, and transporting of raw materials, and in manufacturing and delivering goods to market. Reuse and recycling helps conserve much of the energy embodied in these goods and materials, which in turn avoids GHG emissions. Sending glass, plastic, and metal to landfill represents a loss of resources as many of these materials can be recycled into other products, thereby reducing the demand for virgin materials in manufacturing and production. In addition to being energy intensive, upstream extraction and processing of raw materials (mining, construction, fuel production, metals processing, etc.) generates enormous volumes of waste material. Forty to seventy times more waste (and associated emissions) is generated from the upstream industrial processes associated with product manufacturing than with their disposal to landfill.[32]

Composting organic waste material, including food scraps, non-recyclable paper products, and plant material keeps these materials out of out of landfills, where anaerobic decomposition releases methane (CH4) – a powerful GHG. An added benefit of composting is that land application of the end product increases soil carbon uptake and lowers the demand for water, fertilizer and other soil inputs.

The City is well positioned to build on its recent progress. Pursuant to AB 341 (2011), the State of California is required to divert 75 percent of its solid waste from landfills by 2020. Recycling and organics diversion are the two fundamental tactics recommended for reaching this goal and others. The City can attain such targets by focusing on improving recycling and composting programs and increasing participation. The City's existing contractual relationship with Waste Management may allow the City to meet this goal.

Table 4-4 summarizes the Climate Action Plan's solid waste diversion strategies and their estimated GHG reduction impact.

Table 4-4
Summary of GHG Reduction Impacts for Solid Waste Strategies in 2020

| | Goal/Supporting Strategy | Annual GHG Reduction Potential (MT CO2e) | Priority | First Year of Implementation | Percent of Category |
|---|---|---|---|---|---|
| SW.1 | Reduce Per Capita Community Solid Waste Sent to Landfill | | | | |
| SW.1.1 | Total Community Waste Tonnage Sent to Landfill | 86 | 2 | 2014 | 90% |
| SW.2 | Reduce Per Capita Municipal Operations Solid Waste Sent to Landfill | | | | |
| SW.2.1 | Municipal Solid Waste Sent to Landfill | 10 | 2 | 2014 | 10% |
| | **SECTOR TOTAL** | **96** | | | **100%** |

The City will prioritize the diversion of waste from landfill as its primary solid waste goal. Increasing waste diversion will entail writing and implementing new policy, expanding and improving recycling and composting programs, maximizing the use of technical assistance, and increasing public awareness and education.

# Strategy SW.1.1: Total Community Waste Tonnage Sent to Landfill.

Reduce per capita community solid waste sent to landfill by 20% by 2020 and by 35% by 2030, compared with the baseline year 2005, through additional recycling, green waste diversion, and waste reduction associated with the community.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Near-term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 86 |
| Estimated Annual Cost to the City in 2020: | Medium (City staff time) |
| Responsibility: | Community Development Department and Public Works Department |
| Local Co-benefits: | Reduce waste, lower energy demand, improve traffic and air quality |

**Action SW-1.1a:** Coordinate with Waste Management and Stanislaus County to prepare and distribute educational materials to the public on recycling programs, and to promote solid waste source reduction and benefits of composting.

**Action SW-1.1b:** Work with Waste Management to expand the recycling program to include non-residential uses and multi-family residential uses.

**Action SW-1.1c:** Work with Waste Management to explore expanding the recycling program to include food waste and green waste for all users.

**Action SW-1.1d:** Continue to serve on and/or coordinate with the Stanislaus County Local Task Force on Solid Waste Management to ensure that services for solid waste collection, recycling, and disposal meet the needs of the community.

The City aims to reduce per capita community solid waste sent to the landfill by 20% by 2020 and by 35% by 2030, compared with the baseline year 2005, through additional recycling, green waste diversion and composting, and waste reduction associated within the community. The City will take the following steps to achieve these targets:

- Coordinate with Waste Management and Stanislaus County to prepare and distribute educational materials to the public on recycling programs, and to promote solid waste source reduction and benefits of composting. These educational materials could consist of brochures and flyers made available or sent to residents and businesses, and information about recycling programs can be posted on the City's website.
- Under California law (AB 341), any commercial business or public entity that generates more than four cubic yards of commercial solid waste per week, or is a multifamily residential dwelling of five units or more, is required to recycle after July 1, 2012. The City will continue to work with Waste Management to ensure the recycling program addresses this requirement, and includes other non-residential entities not meeting this criteria such that recycling is maximized in Hughson. Work with Waste Management to expand the recycling program to include non-residential uses and multi-family residential uses that are not covered under AB 341.

- Work with Waste Management to explore expanding the recycling program to include food waste and green waste for all users for composting. Landfills are a large source of methane, which is produced when organic waste decomposes in an environment without oxygen. Composting is a natural way of recycling organic material and nutrients back into the earth, where organic materials are allowed to decompose in a manner that does not produce methane.
- Continue to serve on and/or coordinate with the Stanislaus County Local Task Force on Solid Waste Management to ensure that services for solid waste collection, recycling, and disposal meet the needs of the community.

## Goal SW.2 Reduce Per Capita Municipal Operations Solid Waste to Landfill

## Strategy SW.2.1: Municipal Solid Waste Sent to Landfill.

Reduce per capita municipal operations solid waste sent to landfill by 20% by 2020 and by 35% by 2030, compared with the baseline year 2005, through additional recycling, green waste diversion, and waste reduction associated with municipal operations.

| | |
|---|---|
| Priority: | 2 |
| Timeframe to start implementation: | Near-term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 10 |
| Estimated Annual Cost to the City in 2020: | Low (City staff time) |
| Responsibility: | Community Development Department and Public Works Department |
| Local Co-benefits: | Reduce waste, lower cost to the City |

**Action SW-2.1a:** Continue to implement the City's Environmentally Preferable Purchases and Practices Policy to increase use and purchase of recycled products.

**Action SW-2.1b:** Work with Waste Management to expand the recycling program to include City facilities.

The City will concurrently reduce per capita municipal solid waste sent to landfill by 20% by 2020 and by 35% by 2030. Similar to how the City reduce landfill waste at the community level, the City will achieve its target through additional recycling, green waste diversion, and waste reduction associated with government operations. The City will:

- Continue to implement the City's Environmentally Preferable Purchases and Practices Policy to increase use and purchase of recycled products. Hughson's Administrative Policy No. 2011-01 Environmentally Preferable Purchases and Practices Policy requires, when practical and financially viable, to use and purchase recycled products and recycled materials, and encourage its contractors and consultants to do so as well. This policy also requires the City to make resource conservation an integral part of its waste reduction and recycling programs.

- Work with Waste Management to expand the recycling program to include City facilities. Expand the recycling program to include pick up at City facilities. This could be included in the franchise agreement between the City and Waste Management.

# Water Goals and Strategies

- 2020 Business-as-Usual GHG Emissions: 568 MT CO2e
- Annual GHG emissions reductions by 2020: 89 MT CO2e

Emissions associated with consumption of water in Hughson are relatively low, since virtually all community water is pumped from nearby aquifers. By 2020, the City is expected to generate 568 MT CO2e associated with water pumping and delivery operations, constituting approximately 0.5 percent of the City's total emissions.. The strategies included support GHG emissions reduction while providing the co-benefit of water conservation.

## Water Conservation

Water is a precious and limited resource that must be conserved to meet future demands. Water conservation indirectly reduces the energy required for upstream water collection, conveyance, and treatment, and reduces the energy requirements and the process emissions associated with wastewater collection and treatment. The energy intensity of water conveyance is dependent on distance and elevation changes.

Effective ways of conserving water include incentivizing reductions in commercial/industrial outdoor irrigation, providing rebates for residential water conservation devices, and utilizing recycled water. Water conservation actions have many benefits beyond reducing GHG emissions. In addition to maintaining water as a sustainable resource for future generations, conservation buffers communities from the effects of droughts, saves money, and helps sustain wildlife habitats.

The City takes its responsibility to conserve water seriously and actively supports State policies aimed at reducing water use. The California Urban Water Management Planning Act (UWMP Act) requires every California urban water supplier of more than 3,000 customers to adopt an Urban Water Management Plan (UWMP). In 2009, the State passed the Water Conservation Bill of 2009 (SBX7-7), which requires an updated UWMP every 5 years. It also sets a target of a 20 percent reduction in State-wide water use by 2020, requiring local jurisdictions to implement measures to meet the Statewide goal.

The City of Hughson adopted its updated UWMP in 2005. The Hughson UWMP describes 2005 water use and projected water demand through 2020, 2030, and 2035. Within the City limits, the highest water use per acre of land is for residential, followed by right of way uses, closely followed by agricultural uses. According to the UWMP, Hughson's average daily water use was 250 gallons per capita-day (gpcd) in 2005, which is typical for San Joaquin Valley cities. The UWMP outlines strategies to meet the 20 percent reduction goal of SBX7-7 through Demand Management Measures, which are incorporated into the strategies below. The City has already substantially reduced maximum water demand since 2005, from approximately 3.5 million gallons daily (MGD) in 2006 to 2.8 MG in 2011.[33]

Table 4-5 summarizes the Climate Action Plan's water conservation strategies and their estimated GHG reduction impact.

Table 4-5
Summary of GHG Reduction Impacts for Water Strategies in 2020

| | Goal/Supporting Strategy | Annual GHG Reduction Potential (MT CO2e) | Priority | First Year of Implementation | Percent of Category |
|---|---|---|---|---|---|
| W.1 | Increase Community Water Conservation | | | | |
| W.1.1 | Decrease Community Water Consumption | 89 | 3 | 2014 | 100% |
| W.2 | Reduce Municipal Operations Water Consumption | | | | |
| W.2.1 | Decrease Municipal Operations Water Consumption | N/A | 3 | 2014 | N/A |
| | **SECTOR TOTAL** | **89** | | | **100%** |

# Goal W.1 Increase Community Water Conservation

## Strategy W.1.1: Decrease Community Water Consumption.

### Reduce community water consumption by 20% by 2020.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Near-term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | 89 |
| Estimated Annual Cost to the City in 2020: | Low (City staff time) |
| Responsibility: | Community Development Department and Public Works Department |
| Local Co-benefits: | Lower water bills |

**Action W-1.1a:** Increase the efficiency of existing community plumbing fixtures and promoting available rebates from utility companies for the installation of higher efficiency plumbing fixtures.

**Action W-1.1b:** Prepare and adopt a Water Efficient Landscaping Ordinance.

The City will meet State water use reduction requirements, under the Water Conservation Act of 2009 (SB7x7), to reduce community water consumption by 20% from the 2005 baseline. The City will take the following actions to meet the target, including:

- Reduce water consumption in existing residential and commercial buildings by increasing the efficiency of existing plumbing fixtures (as described in Strategy E.1.2 and E.1.3) and by promoting available rebates from utility companies for the installation of higher efficiency plumbing fixtures.
- Implement water efficient landscaping requirements to reduce water consumption by preparing and adopting a Water Efficient Landscaping Ordinance.

# Goal W.2

# Reduce Municipal Operations Water Consumption

## Strategy W.2: Decrease Municipal Operations Water Consumption.

Reduce municipal operations water consumption by 20% by 2020.

| | |
|---|---|
| Priority: | 3 |
| Timeframe to start implementation: | Near-term (2014) |
| Annual GHG Reduction Potential in 2020 (MT CO2e): | Supporting measure |
| Estimated Annual Cost to the City in 2020: | Low (City staff time) |
| Responsibility: | Community Development Department and Public Works Department |
| Local Co-benefits: | Lower water bills |

**Action W-1.1b:** Expand the City's non-potable water system to include all parks and schools in the City of Hughson.

In addition to community water conservation (Strategy W.1.1) the City will reduce water use at the government operations level by 20% by 2020, as called for under the Water Conservation Act of 2009 (SB7x7).

The City has designed a non-potable water system and implemented the first phase of the system. Non-potable water is now used for 35 acres of turf at the high school. At the completion of the non-potable water system, a total of 56 acres will use non-potable water for irrigation of turf. This will include all parks and schools in the City of Hughson.

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29 Source: NHTSA, Summary of Fuel Economy Performance, 2012. www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/2011_Summary_Report.pdf
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# 5 Preparing Hughson for Climate Change

## Overview

This chapter presents an overview of the impacts Hughson is expected to experience due to projected changes in the climate, and what the City can do to begin preparing for them. Despite serious efforts by Hughson and the State of California to reduce GHG emissions, changes in our climate cannot be avoided entirely over the long term. Even if GHG emissions were reduced to pre-industrial levels today, the GHG emissions that have already been added to the atmosphere will continue to warm the planet for centuries. While mitigation is still the most cost-effective approach to preventing long-term catastrophic impacts of climate change, adaptation efforts are needed to increase the resilience of communities and natural resources to changes expected over the next few decades.

## Expected Local Impacts

In California, anticipated climate change impacts include sea level rise; increased periods of drought; and more frequent extreme weather events, including heat waves and severe storms. Secondary effects include projected inundation of the shoreline; more frequent and severe flooding; more frequent and severe wildfires on the urban fringe; a less reliable water supply; altered agricultural productivity, increased incidence of disease and mortality (both from effects of heat waves and from changing patterns of disease distribution); and disruption of local ecosystems.

The recently published *California Planning Adaptation Planning Guide: Understanding Regional Characteristics (July 2012)*[34] designates climate impact regions based on county boundaries in combination with projected climate impacts, existing environmental setting, socioeconomic factors, and regional designations. The City of Hughson and Stanislaus County are located within the Northern Central Valley climate impact region. As discussed in detail in Chapter 3, Climate Change Background and Regulatory Setting of this CAP, the *Adaptation Planning Guide* identifies the following climate change impacts.

**Temperature increases.** January temperatures are predicted to increase by about 4 to 6 degrees Fahrenheit by 2050 and between 8 to 12 degrees Fahrenheit by the year 2100 within the Northern Central Valley climate impact region. July increases in average temperatures are anticipated to be 6 to 7 degrees Fahrenheit and 12 to 15 degrees Fahrenheit by the year 2100. These increases would intensify already high temperatures, especially in the summer months. In addition, areas of urban development contain asphalt roads and concrete roofs that create and retain heat causing an urban heat island effect.

**Reduced precipitation.** Annual precipitation in Stanislaus County is predicted to decline by approximately one to two inches by the year 2050 and three to six inches by 2100. Reduced precipitation will adversely impact the water supply of the City, region, and State.

**Flooding.** The eastern part of the Northern Central Valley contains the foothills of the Sierra Nevada mountain range, which are projected to have less precipitation falling as snow and to be subject to rapid melt events. Thus, extreme, high flow events and flooding could occur in the City of Hughson and surrounding communities. The City of Hughson should evaluate local floodplains and determine areas of the City where a small increase in flood height would inundate a large area.

Figure 5-1
Projected Temperature Increase

| | | |
|---|---|---|
| Historical Average | 60.2 °F | |
| Low-Emissions Scenario: | 64.3 °F | +4.1 °F |
| High-Emissions Scenario: | 66.9 °F | +6.7 °F |

Figure 5-2
Observed and Projected Temperatures

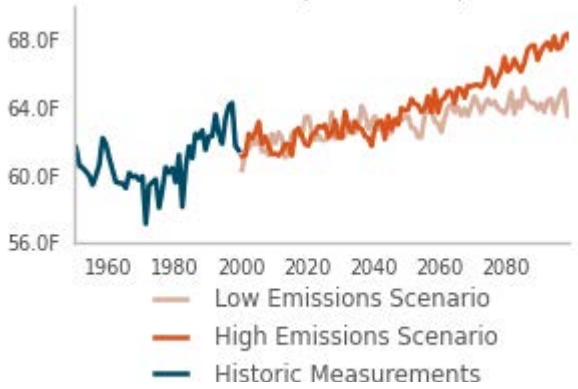
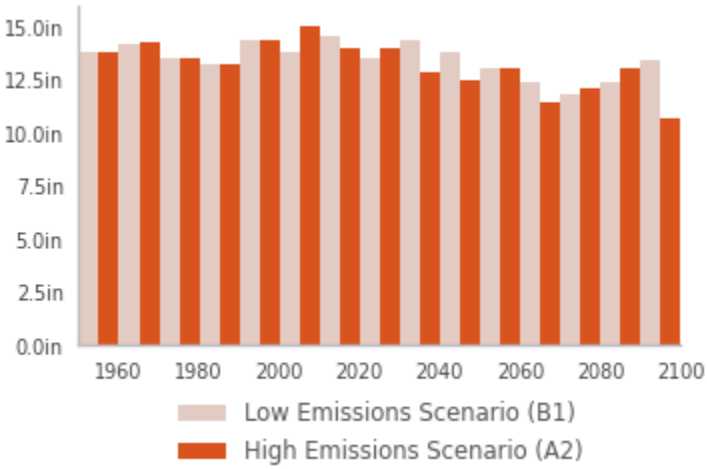



Figure 5-3
Projected Precipitation Levels




**Reduced agricultural productivity.** The agricultural industry is an important component of the local economy, and the Northern Central Valley region is one of the largest agricultural producing areas of the United States. Climate change impacts on water availability and temperature changes will likely affect the health of livestock and productivity of trees and crops. These impacts on agricultural productivity have the potential to alter a community's economy, including its employment base. The primary agricultural crop in the City of Hughson is almonds. Other crops include walnuts, peaches, apricots, beans, and milk. Each crop represents different vulnerabilities to climate change impacts. Specifically, nut trees would be affected by a reduction in nighttime cooling, while increased temperatures could influence the productivity of dairy cows.

**Reduced water supply.** Snowmelt from the Sierra Nevada flows west into the San Joaquin and Sacramento Rivers, which run through the region. The confluence of these two rivers occurs in the Sacramento-San Joaquin Delta, located northwest of Hughson and Stanislaus County. The water

supply for the region consists of a combination of groundwater and surface water with a heavy reliance on the surface water conveyance systems that provide the inflow to the Sacramento-San Joaquin Delta. Relevant climate change impacts include reduced precipitation and increased temperatures, which affect water supply.

**Wildfires.** The north and eastern portions of the Northern Central Valley climate impact region are expected to experience an increase in wildfire risk. In some areas, the wildfire risk is anticipated to be more than four times the current levels. There is increased wildfire risk in the eastern portions of Stanislaus County; however, climate change is not expected to increase wildfire risk in Hughson.

**Public health and heat.** Extreme heat events can pose a public health risk to Hughson residents by increasing the prevalence of vector-borne diseases, worsened air quality, and heat-related illnesses. The Northern Central Valley climate impact region, which includes the City, will experience two to three additional heat waves per year by 2050 with five to eight more by the year 2100. A heat wave is defined as five days over 102 to 105 degrees Fahrenheit. Frequent heat waves can have the greatest impact on the elderly and children less than five years of age.

# Adaptation Planning Approach

Effective adaptation planning and management entails dealing with uncertainty. Adaptation is likely to be a long-term process, including immediate action when necessary and allowing adjustments to changing conditions and new knowledge. Effective public engagement and education is critical, along with an inclusive planning process that ensures the resulting actions are feasible and widely accepted. Adaptation will likely be an ongoing process of planning, prioritization and specific project implementation. It is generally accepted that the next few decades provide a period of opportunity to develop adaptation plans and actions.

Five important steps to effective adaptation planning are summarized below:

- **Increase Public Awareness; Engage and Educate the Community**

  Local outreach campaigns to build awareness of the dangers of heat exposure and to promote low-cost and low-GHG adaptation strategies. It is critical that the public understand the magnitude of the challenge and why action is needed. The planning process should be inclusive of all stakeholders. These efforts should leverage similar efforts undertaken at the regional, state, and federal levels.

- **Assess Vulnerability**

  Perform a detailed vulnerability analysis to assess potential climate change impacts to infrastructure and natural systems. Both short-term and long-term adaptation strategies should be identified. Level of risk can be categorized in terms of likelihood of damage within the forecasting period and the severity of the damages. Understanding vulnerability to climate change impacts is critical to developing effective adaptation strategies. The vulnerability assessment can also provide a framework for agency and community education and participation, feed into other planning documents, and identify funding needs.

- **Establish Goals, Criteria and Planning Principles**

  Engage with stakeholders to establish planning priorities, decision criteria, and build community support for taking action. Rank physical and natural assets for preservation efforts. Where

possible, look for situations where a mitigation action has adaptation co-benefits (e.g., planting trees to reduce urban heat islands while sequestering carbon and providing habitat).

- **Develop Adaptation Plan**

  Identify specific strategies, develop cost estimates, and prioritize actions to increase local resilience of City infrastructure and critical assets, including natural systems like wetlands and urban forests. Look for synergies between natural processes and engineering solutions. An adaptation plan should include a prioritized list of actions (e.g. projects), with a timeline, capital expenditure plan, and a framework for monitoring and adaptive management.

- **Ongoing Monitoring and Adaptive Management**

  Reassess climate change vulnerabilities on a regular basis and modify actions accordingly. This includes monitoring the effectiveness of current policies, strategies and actions, and keeping up with changing science, funding opportunities, and regulatory actions.

# Adaptation Planning Strategies

In lieu of a detailed vulnerability assessment, the City has identified the following strategies and actions to consider implementing as it begins planning for climate change adaptation. These strategies and actions are consistent with those identified in the *California Adaptation Planning Guide: Identifying Adaptation Strategies*. While many of the strategies and actions identified in Chapter 4 Reduction Goals and Strategies of this CAP help to prevent further climate change, the adaptation strategies below prepare Hughson residents and businesses to deal with future climate change impacts. It should be noted that many GHG reduction measures identified in this document also provides adaptation benefits. For example, water conservation, energy efficiency, and improving the urban forest are all strategies with co-benefits that will help Hughson prepare for climate change impacts.

## Temperature Increases

**Strategy 1:** Prepare for increases in average temperatures.

**Co-benefits:** Lower energy demand and bills, lower operating costs of businesses, improved air quality, a safe and healthy community

**Action 1.1:** Continue to plant shade trees in new parking lots and other large, paved areas of the City to reduce heat island effects.

**Action 1.2:** Educate the public on the location of the designated “cooling centers.”

**Action 1.3**: Educate developers and the public on the use of cool roofs and reflective surfaces to reduce heat island effects.

## Reduced Precipitation and Water Supply

**Strategy 2:** Preserve water sources and prepare for variable water supplies.

**Co-benefits:** Conserve water, protect water quality

**Action 2.1:** Increase capacity for community water storage.

**Action 2.2:** Pursue funding to implement water reclamation and reuse projects.

**Action 2.3:** Protect open space areas that are being used for recharging groundwater or have the potential to be used for recharge.

## Increased Flooding

**Strategy 3:** Prepare for flooding and severe weather events.

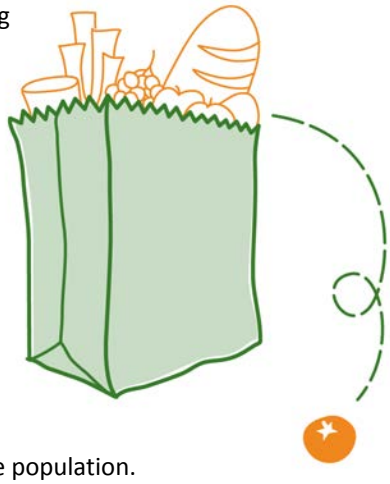
**Co-benefits:** Improve safety of community

**Action 3.1:** Integrate local flood management plans with adaptation planning.

**Action 3.2:** Regularly review and update the City's General Plan to include the latest flood information as required by Government Code Section 65302(a).

**Action 3.3:** Develop storage areas for peak flows.

**Action 3.4:** Maximize use of bioswales and permeable surfaces in both greenscape and hardscape areas to improve aquifer recharge and mitigate flooding from stormwater.



## Reduced Agricultural Productivity and Food Supply

**Strategy 4:** Continue to promote conservation of local agricultural land.

**Co-benefits:** Support local economy, preservation of natural resources

**Action 4.1:** Allow and support farmers markets.

## Public Health

**Strategy 5:** Ensure public health hazards are minimized for all segments of the population.

**Co-benefits:** Improve public health, improve quality of life

**Action 5.1:** Work with Stanislaus County and other jurisdictions in the county to establish a climate change adaptation and public outreach and education program.

**Action 5.2:** Incorporate climate change adaptation into emergency preparedness and response plans such as the Stanislaus County Hazards Mitigation Plan and Hughson Emergency Operations Plan to address public health impacts.

**Action 5.3:** Identify vulnerable communities to various public health concerns associated with climate changes impacts, and ensure that the Hughson Emergency Operations Plan addresses these communities.

**Action 5.4:** Continue to work with the San Joaquin Valley Air Pollution Control District to improve air quality and minimize negative health effects.

**Action 5.5:** Continue to educate the public of vector control to protect the health of Hughson residents.

## Biodiversity and Habitat

**Strategy 6:** Preserve biodiversity and habitats.

**Co-benefits:** Conserve natural resources

**Action 6.1:** Identify and protect locations where native species may shift or lose habitat due to climate change impacts.

**Action 6.2:** Collaborate with agencies managing public lands such as the Department of Fish and Wildlife to identify, develop, and maintain corridors and linkages between undeveloped lands.

## Infrastructure

**Strategy 7:** Respond to potential impacts on public infrastructure.

**Co-benefits:** Lower energy demand and bill, conserve water, a safe community

**Action 7.1:** Consider potential for climate change impacts as part of infrastructure planning and operations.

**Action 7.2:** Assess climate change impacts on community infrastructure to determine any threats to public health and safety.

34 California Emergency Management Agency and California Natural Resources Agency. California Adaptation Planning Guide, Understanding Regional Characteristics, July 2012.

# 6 Monitoring

## Overview

This chapter outlines how the City will monitor the progress of the strategies and actions laid out in Chapter 4 to reduce community-wide GHG emissions and meet its 2020 GHG reduction target. Translating strategies and actions into actual emission reductions will require some municipal code changes, development of programs, City staff time (or interagency regional work-sharing) for promotion activities, and effective management systems for tracking and monitoring program implementation. Coordination between City departments and collaboration with residents, businesses, regional organizations, and other government agencies will be needed to ensure that programs are well-managed and cost-effective.

The Climate Action Plan relies on behavior change to achieve a significant portion of GHG reductions needed to meet the 2020 emissions target. Community involvement is an essential component of the Climate Action Plan implementation process, as many strategies depend on active participation by residents and businesses. The City will be making a concerted effort to develop and strengthen community education and awareness through various promotional programs. These efforts will be monitored for their cost-effectiveness in influencing residents, businesses, and visitors to reduce their personal carbon footprints. The City's web site will also be updated to communicate program development and gauge the success of Climate Action Plan implementation.

This chapter presents an implementation schedule organized into Near-term (2014 – 2015), Medium–term (2016 – 2017), and Long–term (beyond 2018) actions. Actual implementation will depend on a variety of factors, including availability of funding and City staff time, community priorities, and changing environmental demands. However, an annual status report will evaluate program success against the strategy-specific reduction targets outlined in the Chapter 4.

# Program Monitoring

City staff will annually present memorandums to the City Manager summarizing progress of the implementation of Climate Action Plan strategies. The report will evaluate the successes and challenges in meeting the City's GHG reduction goals (as they become known or apparent), provide the status of implementing actions for each reduction strategy (e.g., initiated, ongoing, completed), assess the effectiveness of various strategies and programs included in the Plan, and recommend adjustments to programs or tactics as needed. The annual report will also assess whether the City's actual growth and development is consistent with the forecasts made in this Climate Action Plan. If necessary, the City shall modify the geographic scope of the inventory and emissions targets accordingly.

An update of the City's GHG inventory and a comprehensive revision of the Climate Action Plan should occur at least every five years to monitor progress of GHG reductions against the 2020 target.

City staff will report using benchmarks and metrics that serve as criteria to gauge Plan implementation. A monitoring tool has been developed to track implementation of the following ten reduction strategies (out of the 25 total in the CAP), which collectively are expected to provide 94% of the GHG emission reductions needed to attain the 2020 GHG target for Hughson. Table 6-1 lists the implementation metrics that the monitoring tool will use to estimate the GHG reduction impacts of each strategy.

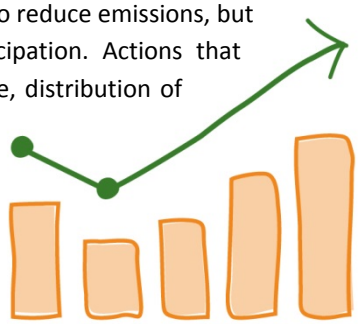
Table 6-1
Implementation Metrics

| ID | Strategy Name | Monitoring Metric | Strategy Target (Performance Metric) |
|---|---|---|---|
| Energy | | | |
| E.1.1 | Residential Green Building Standards | • Total square feet of new residential construction since 2005 that meets 15% above Title 24 | • 3% of new homes built after 2012 to achieve 15% above Title 24 energy savings |
| E.1.2 | Residential Energy Efficiency Promotion | • Existing (as of 2005) residential square feet upgraded since 2005 | • 10% of existing residential square footage upgraded by 2020 |
| E.1.3 | Commercial Energy Efficiency Promotion | • Existing (as of 2005) commercial square feet upgraded since 2005<br>• Post-2005 commercial square feet upgraded since 2005 | • 30% of existing (2005) commercial space to be upgraded by 2020<br>• 100% of Post-2005 commercial space to be upgraded by 2020 |
| E.1.5 | Industrial Equipment Energy Efficiency | • Existing (as of 2005) industrial square feet upgraded since 2005 | • 30% of City's 2005 non-residential square footage to be upgraded by 2020 |
| E.1.6 | Shade Trees | • Number of Housing Units participating in shade tree program<br>• Number of Commercial Units participating in shade tree program<br>• Number of trees planted per year | • 2% of City's housing units participating in Shade Tree Program by 2020<br>• 1% of City's commercial units participating in Shade Tree Program by 2020<br>• 2,820 trees planted in City by year 2020 |
| E.2.1 | On-Site Renewable Energy for Homes | • Number of New Solar PV Systems by 2020 | • 10% of City's homes install solar system by 2020; average capacity = 4 kW. |
| Transportation | | | |
| T.1.1 | Local Commute Trip Reduction | • Number of local employees participating in a 4-day/40-hr workweek<br>• Number of City residents participating in carpool program | • 2% of local employees participating in a 4-day/40-hr workweek by 2020<br>• 1% of City population participating in carpool program by 2020 |

Table 6-1 (cont.)
Implementation Metrics

| | | | |
|---|---|---|---|
| Land Use | | | |
| LU.1.1 | Sustainable Growth Patterns | • Percent increase in residential units/acre since 2005<br>• Percent increase in local jobs since 2005 | • 24% Increase in residential units/acre by 2020<br>• 1% increase in local jobs by 2020 |
| Solid Waste | | | |
| SW.1.1 | Total Community Waste Tonnage Sent to Landfill | • Percent reduction in per capita community waste sent to landfill, relative to 2005 | • 25% per capita reduction in community waste sent to landfill by 2020 |
| Water | | | |
| W.1.1 | Decrease Community Water Consumption | • Percent Reduction in water consumption, relative to 2005 | • 2% per capita reduction in water consumption by 2020 |

# Schedule of Implementation



For the most part, the City will be responsible for initiating the actions to reduce emissions, but success for many measures will ultimately depend on public participation. Actions that require active City promotion may require updates to the City website, distribution of physical promotional materials, and other active City outreach activities. The City will develop programs to reach the public, including public forums, workshops, and meetings; these programs will be administered with the intent to foster an open public input and commenting process. Collaboration and coordination with transit agencies [e.g., Stanislaus County Regional Transit (StaRT), Riverbank-Hughson Transit Authority (ROTA)] will be essential to improving and increasing transit ridership, and enhancing mobility and transportation efficiency through better planning.

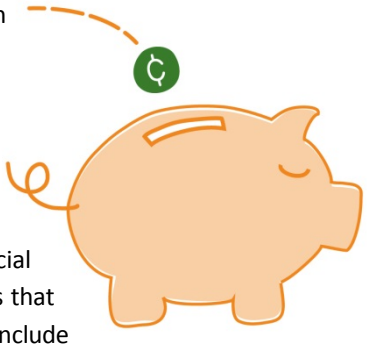
Further, coordination with outside agencies and private entities is critical for the success of many strategies, including PG&E and TID for energy conservation and renewable energy programs, the local garbage hauler (Waste Management, Inc.) for waste reduction actions, the local water purveyors for water saving actions, and other local jurisdictions for work-sharing partnerships designed to take advantage of the common goals across Stanislaus County and the San Joaquin Valley Air Pollution Control District. Dependence on outside agency participation is mentioned explicitly in the strategy descriptions included in Chapter 5. The City will explore strategies for collaboration.

All of the strategies described in Chapter 4 are categorized below by when implementation is due to begin: Near-term (calendar years 2014-2015), Medium–term (2016-2017), and Long–term (2018 and beyond).

## Table 6-2
Schedule of Implementation

| | Short-Term (2014-2015) | Medium-Term (2016-2017) | Long-Term (2018 and beyond) |
|---|---|---|---|
| Energy | | | |
| E.1.1: Residential Green Building Standards | ● | | |
| E.1.2: Residential Energy Efficiency Promotion | ● | | |
| E.1.3: Commercial Energy Efficiency Promotion | ● | | |
| E.1.4: Use of Smart Meters | ● | | |
| E.1.5: Industrial Equipment Energy Efficiency Promotion | ● | | |
| E.1.6: Shade Trees | ● | | |
| E.2.1 : On-Site Renewable Energy for Homes | ● | | |
| E.2.2: On-Site Renewable Energy for Commercial and Industrial Users | ● | | |
| E.2.3: Regional Renewable Energy Partnerships | | ● | |
| E.3.1: Municipal Energy Efficiency | ● | | |
| E.3.2 : Municipal On-Site Renewable Energy Sources | | | ● |
| Transportation and Land Use | | | |
| T.1.1: Local Commute Trip Reduction | ● | | |
| T.1.2: Regional Transportation Management | ● | | |
| Transportation and Land Use (continued) | | | |
| T.1.3: Parking Management | ● | | |
| T.2.1: Bicycle and Pedestrian Infrastructure Improvement | ● | | |
| T.2.2: Safe Routes to Schools | ● | | |
| T.3.1: Public Transit Expansion | | ● | |
| T.4.1: Increase Motor Vehicle Efficiency | | ● | |
| T.4.2: Fuel Efficiency for Municipal Fleet | ● | | |
| LU.1.1: Sustainable Growth Pattern | ● | | |
| LU.2.1: Farmer's Markets | ● | | |
| Solid Waste | | | |
| SW.1.1: Total Community Waste Tonnage Sent to Landfill | ● | | |
| SW.2.1: Municipal Solid Waste Sent to Landfill | ● | | |
| Water | | | |
| W.1.1: Decrease Community Water Consumption | ● | | |
| W.2.1: Reduce Municipal Operations Water Consumption increase Community Water Conservation | ● | | |

# Funding Sources



The capacity of the City of Hughson to implement the Climate Action Plan is limited by the small number of staff at the City and available funding. In addition to the program implementation costs to the City, there will be costs borne by residents and businesses to comply with its requirements.

The GHG reduction strategies in this document were formulated with an understanding that the City has limited staff time and financial resources to implement them. Cost estimates are provided for strategies that have quantified GHG reductions. The City's costs for implementation include the creation or promotion of voluntary programs, continuing administration of those programs, coordination and outreach with other government agencies and businesses, and—in some cases—exploration or study of potential legislative or regulatory mechanisms not yet codified. Only a few strategies require up-front capital expenditures by the City.

The City will use a combination of City staff time, grant funding, direct spending, and collaboration with other agencies and organizations to achieve Climate Action Plan goals. The following funding sources are available or potentially available to assist with achieving these goals

## Existing Resources

### City Staff

City staff time will be required to successfully implement Climate Action Plan measures. Community Development Department staff will implement the majority of the actions outlined in Chapter 4. The Public Works Department will also assist with the implementation of some strategies. Promotional activities are likely to require significant City staff time, and will require updating the City website, public outreach campaigns (e.g. workshops), dissemination of promotional materials (e.g. flyers), and other forms of public awareness outreach and education.

### Work Sharing

Given the rural location and size of the City of Hughson, and the limited financial resources, City officials have been exploring work-sharing opportunities with other local and regional and jurisdictions. Under these arrangements, "combined" staff would devote a portion of their time to goals and strategies that are similar or consistent across several jurisdictions, such as promotion of existing energy efficiency rebates to reduce total energy use. These collaborations are expected to also promote cross-pollination of ideas and establish relationships that will be beneficial for future discussions with regional agencies regarding efforts to reduce GHG emissions.

## Potential Funding and Partnerships

Federal, state, and regional agencies provide grants and loans, as well as planning assistance, for investments in a variety of climate-related projects. Grants and loans can provide short-term funding for program development and program testing, and could help pay for the staff time required to develop programs,

and then establish an alternative financial framework for the program's continued operation after the grant expires.

The City will continue existing partnerships with other organizations such as the Northern Central Valley Energy Improvement Joint Powers Authority to implement, fund, and finance energy conservation and renewable energy projects and programs for residential uses, and the San Joaquin Valley Clean Energy Partnership to apply for the California Energy Commission (CEC) Energy Efficiency and Conservation Block Grant (EECBG) to fund energy efficiency projects. Some of the specific, available funding programs are listed below.

## Federal

### Safe Routes to Schools

Safe Routes to Schools is an international movement focused on increasing the number of children who walk or bicycle to school by funding projects that remove barriers to doing so. These barriers include a lack of infrastructure, safety, and limited programs that promote walking and bicycling. In California, two separate Safe Routes to School programs are available at both the state and federal level, and both programs fund qualifying infrastructure projects.

### TEA-21

Federal funding through the TEA-21 (Transportation Equity Act for the 21st Century) program is administered through the state and regional governments. The City of Hughson is located in the jurisdiction of the regional Stanislaus Area Association of Governments (STANCOG) agency. TEA-21 funding would be administered through STANCOG. Most of the funding programs are transportation versus recreation oriented, with an emphasis on reducing auto trips and providing an intermodal connection. In most cases, TEA-21 provides matching grants of 80 to 90 percent.

### American Recovery and Reinvestment Act (ARRA) Community Partnerships

Federal funding for local energy efficiency programs is available. Funding for energy efficiency has been provided to the California Department of Community Services and Development, which has dispersed funds locally to the Central Valley Opportunity Center. The Center provides free home weatherization and other energy assistance resources to low-income and elderly citizens of Stanislaus County. Programs include the Low-Income Home Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program (WAP)[35].

### Energy Efficiency Mortgages

The Federal Housing Administration (FHA) offers an Energy Efficient Mortgage Loan program that assists current or future homeowners with lowering their utility bills. This would be accomplished by enabling homeowners to incorporate the cost of adding energy-efficient improvements into their home mortgage. Energy efficient upgrades could be chosen that would allow owners to realize net monthly savings. The goal is to provide owners additional financing for energy efficiency upgrades at a discounted interest rate.

## State

### California Energy Efficiency Financing

For years, the CEC has provided a loan program that supports local government energy retrofits and some new construction projects. Since 1979, more than $272 million has been allocated to more than 773 recipients, as of March 2012. The program provides low interest loans for feasibility studies and the installation of

cost-effective energy projects in schools, hospitals, and local government facilities. The loans are repaid out of the energy cost savings and the program will finance lighting, motors, drives and pumps, building insulation, heating and air conditioning modifications, streetlights and traffic signal efficiency projects, and certain energy generation projects, including renewable energy projects and cogeneration. Loans can cover up to 100% of project costs and there is a maximum loan amount of $3 million.

#### Strategic Growth Council

In September 2008, California Senate Bill 732 created the Strategic Growth Council, which is a cabinet level committee whose tasks include coordinating the activities of member state agencies to assist state and local entities in the planning of sustainable communities and meeting AB 32 goals, including coordination of Planning Grants and Urban Greening Grants.

#### Infrastructure State Revolving Fund

The Infrastructure State Revolving Fund Program provides direct low-cost loans for local governmental public infrastructure projects, such as environmental mitigation measures, parks, transit, and solid waste collection and disposal.

#### Bicycle Transportation Account

The State Bicycle Transportation Account (BTA) is an annual program providing state funds for city and county projects that improve safety and convenience for bicycle commuters. The emphasis is on projects which benefit bicycling for commuting purposes. Funds are allocated to cities and counties on a matching basis that requires the applicant to furnish a minimum of 10 percent of the total project cost, and no applicant shall receive more than 25 percent of the total amount transferred to the BTA in a single fiscal year.

### Regional

Continuing existing partnerships with the neighboring jurisdictions within Stanislaus County, as well as other regional agencies, will help the City in implementing the CAP strategies.

#### SJVACPD Incentive Programs

The City can take advantage of county and region-wide funding opportunities. The San Joaquin Valley Air Pollution Control District (SJVAPCD) provides grant and incentive programs for the replacement of polluting machinery and vehicles within their jurisdiction. For example, they offer a voucher program for legacy on-road heavy-duty trucks at 25 percent and 35 percent of cost. Additionally, SJVAPCD offers grant programs for off-road vehicles (e.g. forklifts, lawn mowers), agricultural pumps, heavy-duty engines, new alternative vehicles for public institutions, and school buses[36].

The wider region is also involved in a variety of sustainable economic development strategies. For example, the Federal U.S. Department of Agriculture (USDA) is coordinating with Stanislaus and 17 other California counties to grow biofuels for jet fuel, with funding and financial incentives of $45 million dollars. Programs like these can help the community of Hughson achieve more sustainable development and can help the State as a whole reduce greenhouse gas emissions.

#### StanCOG

Stanislaus Council of Governments (StanCOG) is the Congestion Management Agency for Stanislaus County. Federal funding for transportation projects and programs is channeled through StanCOG as the Metropolitan Planning Organization (MPO). An essential function of the MPO is to develop a Transportation Improvement

Program (TIP) which is a short-range (four-year) program of transportation improvements based on the long-range transportation plan designed to achieve the area's goals, using spending, regulating, operating, management, and financial tools.

StanCOG's Non-Motorized Transportation Plan has been prepared as a countywide document, but is also intended to guide efforts to improve bicycling and walking conditions at the local level. The plan integrates the results of the County and local general plans, the regional transportation plan and previous bicycle planning efforts. The Plan also represents the County's first comprehensive pedestrian planning effort.

### Private and Non-Governmental Support

Community-based non-profits, local businesses, and utilities should be considered as resources for direct and indirect support, including funding, for project and program activation and operations.

Private investors may provide funding to local governments. For example, energy service companies (ESCOs) can finance the up-front investments in energy efficiency, reimbursed by the local government over a contract period. Private companies may finance solar power installations, and then recoup their investment by selling the resulting power to the building owner.

# CEQA Project Review

Under the California Environmental Quality Act (CEQA), the effects of GHG emissions are considered a potentially significant environmental impact. In addressing climate change, CEQA provides a useful mechanism for local agencies to evaluate the environmental effects of new development, but may also create inefficiencies for both agency staff and applicants through repetitive assessments of small projects on an individual basis, rather than considering cumulative effects of future development and determining needed mitigation up front. The CEQA Guidelines recognize this, and include a provision for streamlining the analysis of projects that are consistent with a comprehensive plan for the reduction of GHG emissions (CEQA Guidelines, Section 15183.5). The City of Hughson Climate Action Plan meets the requirements of CEQA Guidelines Section 15183.5(b)(1) as a plan that analyzes cumulative GHG impacts. The Climate Action Plan uses established protocols, methodologies and forecasts of existing and future land uses to quantify existing and projected future GHG emissions within the plan area. It also establishes a reduction target based on California State law (AB 32), and lays out policies and actions that the City will enact and implement over time to achieve that reduction target, effectively providing sufficient mitigation for new development so as to reduce GHG impacts to less than significant levels.

The Climate Action Plan includes GHG reduction measures that, if fully implemented, would achieve an emissions reduction target that is consistent with and supports the state-mandated reduction target embodied in AB 32. A development project would be consistent with the CAP if it is consistent with the CAP assumptions regarding the amount and type of future development, and is consistent with the GHG reduction measures identified in the CAP. Projects consistent with the CAP, including conformance with any performance measures applicable to the project, would not require additional GHG emissions analysis and mitigation under CEQA Guidelines Sections 15064(h) and 1513.5(b)(2).[1] However, a project applicant

[1] If there is substantial evidence that the effects of a particular project may be cumulatively considerable, notwithstanding the project's compliance with the CAP, CEQA requires that an EIR be prepared.

can always choose to demonstrate compliance with the AB 32 target by preparing an individual analysis that calculates GHG emissions as part of their CEQA documentation.

In order to assist with determining project consistency with the CAP, a project consistency checklist is provided below. The checklist is intended to provide individual projects the opportunity to demonstrate that they are minimizing GHG emissions, while ensuring that new development in the City will achieve a proportion of emissions reduction consistent with what is assumed in the CAP. The CAP provides a range of feasible measures and quantifies their effectiveness to demonstrate that the City's reduction target can be met. The project review checklist screens projects for important GHG reduction measures that, when implemented, will facilitate and not impede the City's ability to meet its 2020 GHG emissions target. The checklist applies to all projects subject to CEQA.

To ensure that the checklist provides a valid screening tool for GHG impacts, the City will undertake the following actions:

1. Ensure that total development through 2020, including the impacts of any proposed project, will be consistent with the following growth assumptions used to develop the GHG emissions forecasts in this plan: 2020 employment is projected to be 700 jobs in Hughson, while 2020 housing units are projected to be 2,550 located within Hughson's current City Limits and Sphere of Influence.[2] These projections are anticipated to result in 120 additional jobs by 2020 as compared to 2010, and 316 additional dwelling units in 2020 as compared to what was built and entitled in 2010. Any proposed development project that will result in total jobs or total housing units exceeding these projections must undergo CEQA review for GHG emissions impact.

2. The Key Implementing Actions for each of the ten GHG reduction strategies in the CAP Monitoring Tool will be completed by the target date(s) indicated in the Tool.

3. The City will stay on track to meet the individual strategy targets (performance metrics) for the ten GHG reduction strategies in the CAP Monitoring Tool, as summarized in Table 6-1.

A project that does not meet all of the criteria listed below in the Development Project Consistency Checklist will have to demonstrate compliance with the AB 32 target by preparing an individual analysis that calculates GHG emissions as part of the required CEQA documentation.

[2] Stanislaus County Council of Governments, RTIF Demographic Projections, July 2012.

## Development Project Consistency Checklist

If the actions described above are undertaken by the City, all projects that meet the following criteria are exempt from providing additional analysis to calculate GHG emissions under CEQA:

1. New residential project developments are consistent with the 2005 Hughson General Plan land use designations and densities, or would result in the same or higher density under a general plan amendment.
2. New residential project developments are consistent with the City's Zoning Code districts and densities, or would result in the same or higher density under a zone code change.
3. Project is consistent with the 2020 housing and employment projections assumed in this CAP.
4. Project is consistent with the City Codes and ordinances that require planting of new trees, protection of existing trees and replacement of trees that are removed, and implementing landscape requirements.
5. New residential project developments demonstrate energy efficiency at least 15% beyond Title 24 standards for energy efficiency (CalGreen Tier 1).
6. New industrial users implement the San Joaquin Valley Air Pollution Control District Best Performance Standards.
7. All commercial and industrial projects with 100 employees or more will implement a local trip reduction program consistent with the San Joaquin Valley Air Pollution Control District's Employer Based Trip Reduction Program (Rule 9410).

35 CVOC, http://www.cvoc.org/programs.html, web site accessed on May 6. 2013.
36 SJVAPCD, Grant and Incentive Programs. http://www.valleyair.org/grant_programs/grantprograms.htm#On-Road Voucher Incentive Program).

# APPENDIX A: ICF COMMUNITY INVENTORY

# Hughson

Total GHG emissions for the City of Hughson in 2005 were 31,187 MT $CO_2e$. City of Hughson GHG emissions inventory is shown in Figure 3-3 and 3-4 and reported in table 3-2. The primary sources of GHG emissions in Hughson are on-road transportation (41%), building natural gas (34%), and building electricity (9%). Total per capita and per service population emissions are 5.1 MT $CO_2e$/person and 4.6 MT $CO_2e$/SP, respectively. Residential per capita GHG emissions for Hughson are consistent across the building energy (1.1 MT $CO_2e$/person) and waste generation sectors (0.02 MT $CO_2e$/person) when compared to average values for the region as a whole (1.5 MT $CO_2e$/person and 0.02 MT $CO_2e$/person). The municipal GHG inventory for the City of Hughson is available from the City upon request.

**Table 3-2. 2005 GHG Emissions Inventory for the City of Hughson (MT $CO_2e$)**

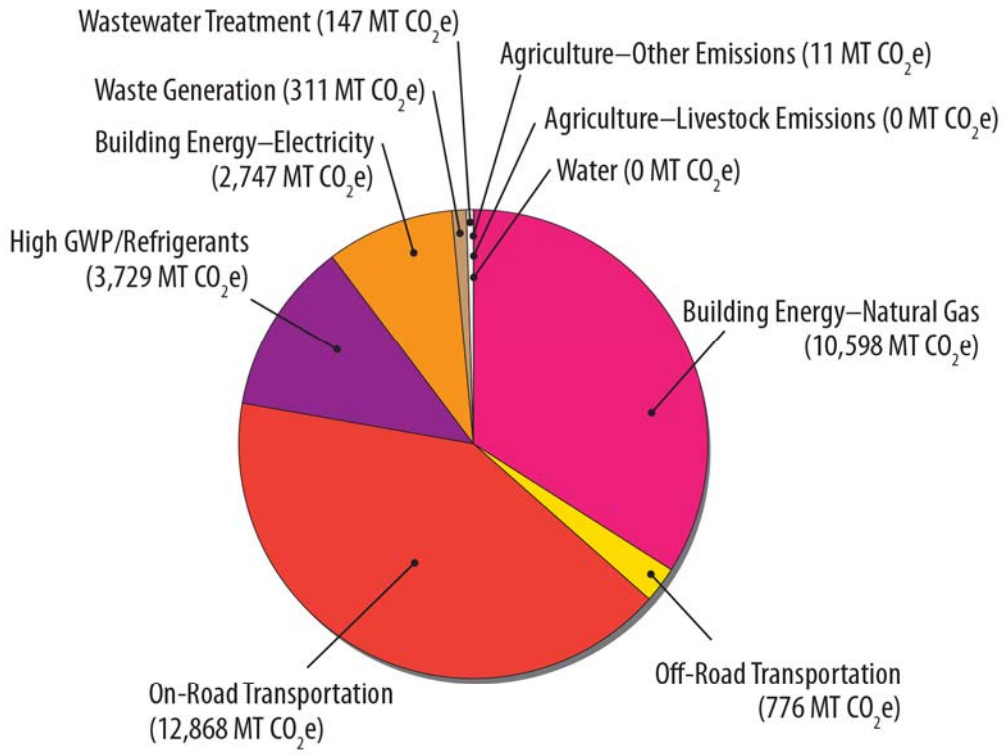
| | Sector | Emissions | Percent |
|---|---|---|---|
| Direct[a] | Agriculture—Livestock Emissions | N/A | N/A |
| | Agriculture—Other Emissions | 11 | 0.04% |
| | Building Energy—Natural Gas | 10,598 | 33.98% |
| | Off-Road Transportation | 776 | 2.49% |
| | On-Road Transportation | 12,868 | 41.26% |
| | High GWP/Refrigerants | 3,729 | 11.96% |
| Indirect[b] | Building Energy—Electricity | 2,747 | 8.81% |
| | Waste Generation | 311 | 1.00.% |
| | Wastewater Treatment | 147 | 0.47% |
| | Water | N/A | N/A |
| Total | | 31,187 | 100.00% |
| Excluded[c] | Stationary Sources | 5,189 | |
| | Waste Landfill | N/A | |

a. Direct emissions are emissions that physically occur within the City boundary; see Chapter 1 for detail.

b. Indirect emissions are due to activity that occurs within the City boundary although the GHG emission may happen outside the City boundary; see Chapter 1 for detail.

c. Stationary source emissions were excluded due to state and federal regulation of these sources. Landfill emissions were excluded to avoid double-counting with waste generation emissions.

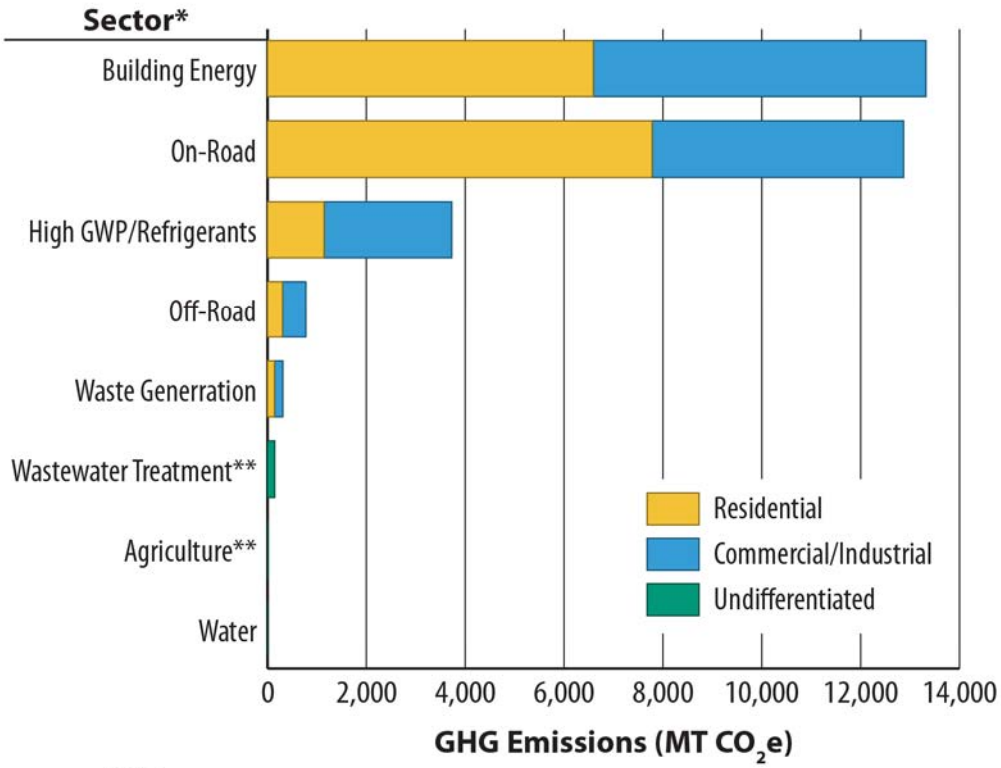
**Figure 3-3. 2005 GHG Emissions Inventory for the City of Hughson (MT $CO_2e$)—Sector View**


Wastewater Treatment (147 MT CO2e)
Agriculture–Other Emissions (11 MT CO2e)
Waste Generation (311 MT CO2e)
Agriculture–Livestock Emissions (0 MT CO2e)
Building Energy–Electricity (2,747 MT CO2e)
Water (0 MT CO2e)
High GWP/Refrigerants (3,729 MT CO2e)
Building Energy–Natural Gas (10,598 MT CO2e)
On-Road Transportation (12,868 MT CO2e)
Off-Road Transportation (776 MT CO2e)

**Total Emissions: 31,187 MT $CO_2e$**

Note:
Emissions sectors not included in this chart:
Landfill Sites (0 MT $CO_2e$)
Stationary Sources (5,189 MT $CO_2e$)

**Figure 3-4. 2005 GHG Emissions Inventory for the City of Hughson (MT $CO_2e$)—End Use and Sector View**




Notes:

* Emissions sectors not included in this chart:
Landfill Sites (0 MT $CO_2e$)
Stationary Sources (5,189 MT $CO_2e$)

**Emissions could not be apportioned by end-user. Includes residential, commercial, industrial, or agricultural emissions.

# APPENDIX B: ICLEI MUNICIPAL OPERATIONS INVENTORY

# City of Hughson, CA

## 2005 Government Operations

## Greenhouse Gas Emissions Inventory

**Narrative Report**

Produced by Bryce Dias
Supported by Pacific Gas and Electric Company
In Collaboration with the Great Valley Center and
ICLEI-Local Governments for Sustainability USA

September 12, 2011

# Credits and Acknowledgements


## City of Hughson

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## The Great Valley Center

Stacey Shepard, South Valley Energy Representative
Bryce Dias, Project Associate

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Pacific Gas and Electric Company provides comprehensive climate planning assistance to local governments, from providing energy usage data and assistance with greenhouse gas inventories, to training and guidance on climate action plans.

This program is funded by California utility customers and administered by PG&E under the auspices of the California Public Utilities Commission.

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This report was prepared by Stacey Shepard, Energy Representative and Bryce Dias, Project Associate at the Great Valley Center. The authors would like to thank the City of Hughson staff for providing much of the insight and local information necessary for the completion of this report.

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# Executive Summary

## City of Hughson Profile

The City of Hughson covers over 1.65 square miles and is located in the Great Central Valley, north of Turlock, southeast of Modesto, and east of Ceres. The City of Hughson is the smallest incorporated city in Stanislaus County, with an estimated population of 5,926 on Jan. 1, 2005 and 6,090 on Jan. 1, 2006. With 20 city employees in the year 2005, there was a ratio of approximately 3.3 employees per one thousand residents. The City of Hughson's total budget, including capital projects, was $10,030,501 for fiscal year 2004-2005 and $13,777,174 for fiscal year 2005-2006.

The City of Hughson is located within the climate zone 12, according to U.S. Department of Energy's Climate Zones. Climate zone 12 is classified as a Mediterranean, sub-tropic climate, by the Köppen Classification System, and is characterized by hot, dry summers and mild, wet winters. The City of Hughson experiences a climate similar to the Merced area, which recorded 2,430 heating degree days1 and 995 cooling degree days in 2005.2

## The Purpose of Conducting an Inventory

Each day, local governments operate buildings, vehicle fleets, street lights, traffic signals, water systems, and wastewater plants; local government employees consume resources commuting to work and generate solid waste which is sent for disposal. All of these activities directly or indirectly cause the release of carbon dioxide and other greenhouse gases into the atmosphere. This report presents the findings and methodology of a local government operations (LGO) greenhouse gas emissions inventory for City of Hughson. The inventory measures the greenhouse gas emissions resulting specifically from City of Hughson's government operations, arranged by sector to facilitate detailed analysis of emissions sources. The inventory addresses where and what quantity of emissions are generated through various local government activities. Through analysis of a local government's emissions profile, the City of Hughson can tailor strategies to achieve the most effective greenhouse gas emission reductions.

Strategies by which local governments can significantly reduce emissions from their operations include increasing energy efficiency in facilities and vehicle fleets, utilizing renewable energy sources, reducing waste, and supporting alternative modes of transportation for employees. The benefits of these actions include lower energy bills, improved air quality, and more efficient government operations, in addition to the mitigation of local and global climate change impacts. By

[1] Heating and Cooling Degree Days are a measurement designed to reflect demand for energy needed to heat or cool a facility, and are calculated as the difference between the average daily temperature for a region and a baseline temperature (usually 65° or 80° F). HDD value is the summation of degrees of the average temperature per day below 65° F for the year. CDD is the summation of degrees of the average temperature per day above 80° F for the year.

[2] Pacific Energy Center's Guide to: California Climate Zones, retrieved from http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zones_01-16.pdf

striving to save taxpayer money through efficient government operations, City of Hughson is working to improve government services in a smart and targeted way that will benefit all of the city's residents.

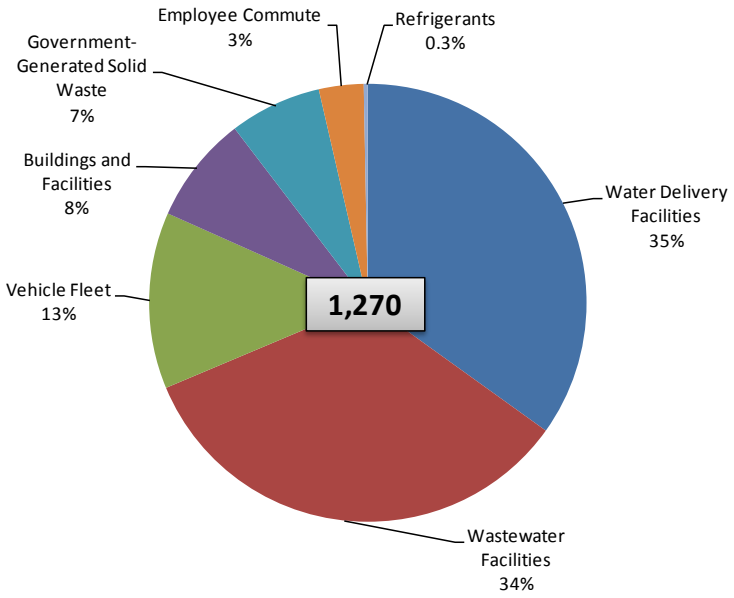
City of Hughson recognizes that climate change resulting from the greenhouse gas emissions of human activities is a reality. Global average surface temperatures are rising due to intensification of activities that release carbon dioxide and other greenhouse gases into the atmosphere. Potential impacts of climate change include rising sea levels, more severe and frequent storms, increased flooding, greater rates of coastal erosion, loss of critical habitat and ecosystems, more severe heat waves, increased precipitation, extended drought conditions, larger wildfires, shortages in water supply, formation of ground level ozone, and heightened exposure to vector born diseases.

By conducting this inventory, City of Hughson is acting now to limit future impacts that threaten the lives and property of Hughson's residents and businesses, make government operations more efficient, and improve the level of service it offers to the residents of Hughson.

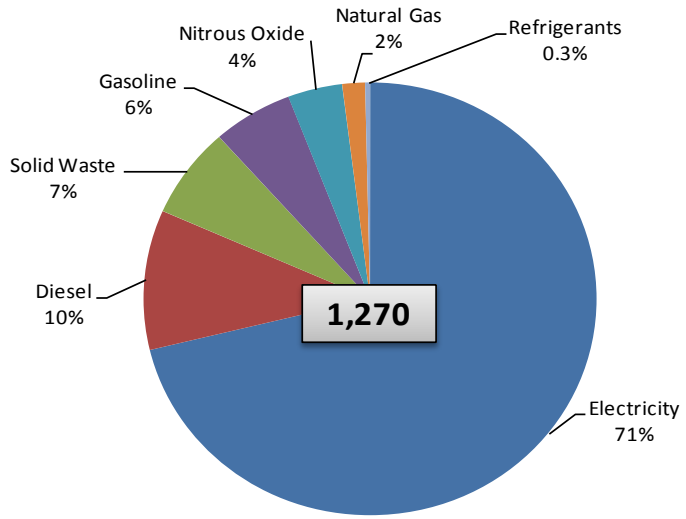
## Inventory Results

The following figures summarize the results of the LGO greenhouse gas emissions inventory for City of Hughson, by sector and source. As illustrated in Figure 1, the sector producing the most greenhouse gas emissions in the City of Hughson is the Water Transport sector at 35%, followed closely by the Wastewater sector at 34%. As shown in Figure 2, electricity is the source with the greatest percentage of emissions at 71% of total emissions. Table 1 delineates the different types of greenhouse gases (CO2, CH4, N2O, etc.), which are assigned a standard metric of carbon dioxide equivalent (CO2 e), and then combined to describe total emissions of the City.

## Figure 1: 2005 Government Operations $CO_2e$ Emissions by Sector




## Figure 2: 2005 Government Operations $CO_2e$ Emissions by Source




## Table 1: LGO Protocol Report - Overall Emissions by Scope

**Total Emissions**

| | $CO_2e$ | $CO_2$ | $CH_4$ | $N_2O$ | HFCs | PFCs | $SF_6$ |
|---|---|---|---|---|---|---|---|
| **SCOPE 1** | 237.571 | 237.571 | 0.005 | 0.160 | 0.003 | - | - |
| **SCOPE 2** | 904.071 | 900.235 | 0.028 | 0.010 | - | - | - |
| **SCOPE 3** | 128.025 | 40.984 | 4.106 | 0.003 | - | - | - |
| **INFORMATION ITEMS** | 8.401 | 8.401 | - | - | - | - | - |

For more detail on the concepts of scopes, sources, and sectors, and to review more granular data produced through the inventory study, please refer to the full report on the following pages.

# Regional and Local Context

## Climate Change Mitigation Activities in California

Since 2005, the State of California has responded to growing concerns over the effects of climate change by adopting a comprehensive approach to addressing emissions in the public and private sectors. This approach was officially initiated with the passage of the Global Warming Solutions Act of 2006 (AB 32), which requires the state to reduce its greenhouse gas emissions to 1990 levels by 2020. The AB 32 Scoping Plan was developed to identify strategies for meeting the AB 32 goal, and was adopted by ARB in December 2008. Among many other strategies, it encourages local governments to reduce emissions in their jurisdictions by 15 percent below current levels by 2020. In addition, it identifies the following strategies that will impact local governance:

- Develop a California cap-and-trade program
- Expand energy efficiency programs
- Establish and seek to achieve reduction targets for transportation-related greenhouse gas (GHG) emissions
- Expand the use of green building practices
- Increase waste diversion, composting, and commercial recycling toward zero-waste
- Continue water efficiency programs and use cleaner energy sources to move and treat water
- Reduce methane emissions at landfills
- Preserve forests that sequester carbon dioxide

Other measures taken by the state include mandating stronger vehicle emissions standards (AB 1493, 2002), establishing a low-carbon fuel standard (EO # S-01-07, 2007), mandating a climate adaptation plan for the state (S-EO # 13-08, 2008), establishing a Green Collar Job Council, and establishing a renewable energy portfolio standard for power generation or purchase in the state. The state also has made a number of legislative and regulatory changes that have significant implications for local governments:

- SB 97 (2007) required the Office of Planning and Research to create greenhouse gas planning guidelines for the California Environmental Quality Act (CEQA). In addition, ARB is tasked with creating energy-use and transportation thresholds in CEQA reviews, which may require local governments to account for greenhouse gas emissions when reviewing project applications.
- AB 811 (2007) authorizes all local governments in California to establish special districts that can be used to finance solar or other renewable energy improvements to homes and businesses in their jurisdiction.
- SB 375 (2008) revises the process of regional transportation planning by metropolitan planning organizations (MPOs), which are governed by elected officials from local jurisdictions. The statute calls on ARB to establish regional transportation-related greenhouse gas targets and requires the large MPOs to develop regional "Sustainable Communities Strategies" of land use, housing and transportation policies that will move the region towards its GHG target. The statute stipulates that transportation investments

must be consistent with the Sustainable Communities Strategy and provides CEQA streamlining for local development projects that are consistent with the Strategy.

## Pacific Gas and Electric Company-Sponsored Inventory Project

With the support of Pacific Gas and Electric Company (PG&E), ICLEI - Local Governments for Sustainability was contracted to work with the Great Valley Center to assist in the quantification of greenhouse gas emissions in City of Hughson and the following other participating communities: the cities of Ceres, Livingston, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, and Waterford. ICLEI is a nonprofit association of local governments that provides information, delivers training resources, organizes conferences, facilitates networking and city-to-city exchanges, carries out research and pilot projects, and offers technical services and consultancy related to climate planning. From 2010 through 2011, ICLEI provided training and technical assistance to participating regional organizations, interns, and local government staff and facilitated the completion of this report.

## Climate Change Mitigation Activities in the City of Hughson

1. Adoption of a new General Plan in 2005 (see appendix).
2. Adoption of a new Zoning Ordinance in 2008 (see appendix).
3. Adoption of a General Plan amendment to add a Conservation and Open Space Element in 2010 (see appendix)
4. Award of an Energy Efficiency Block Grant to modify City facilities for energy efficiency. Project will bid summer of 2011.
5. Award of a Sustainable Communities Planning grant to develop a model Climate Action Plan. Project will complete in 2013.

# Introduction

## General Methodology

### Local Government Operations Protocol

A national standard called the Local Government Operations Protocol (LGO Protocol) has been developed and adopted by the California Air Resources Board (ARB) in conjunction with ICLEI, the California Climate Action Registry, and The Climate Registry. This standard provides accounting principles, boundaries, quantification methods, and procedures for reporting greenhouse gas emissions from local government operations. The LGO Protocol forms the basis of ICLEI's Clean Air & Climate Protection Software (CACP 2009), which allows local governments to compile data and perform the emissions calculations using standardized methods.

### Greenhouse Gases and Carbon Dioxide Equivalent

In accordance with LGO Protocol recommendations, CACP 2009 calculates and reports all six internationally recognized greenhouse gases regulated under the Kyoto Protocol (Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride). Emissions summaries found throughout this report also use CACP 2009's ability to combine emissions from the various greenhouse gases into carbon dioxide equivalent, CO2e. Since equal quantities of each greenhouse gas have more or less influence on the greenhouse effect, converting all emissions to a standard metric, CO2e, allows apples-to-apples comparisons amongst quantities of all six emissions types. Greenhouse gas emissions are reported in this inventory as metric tons of CO2e (MTCO2e).

Table 2 exhibits the greenhouse gases and their global warming potential (GWP), a measure of the amount of warming a greenhouse gas may cause compared to the amount of warming caused by carbon dioxide.

#### Table 2: Greenhouse Gases

| Gas | Chemical Formula | Activity | Global Warming Potential ($CO_2e$) |
|---|---|---|---|
| **Carbon Dioxide** | $CO_2$ | Combustion | 1 |
| **Methane** | $CH_4$ | Combustion, Anaerobic Decomposition of Organic Waste (Landfills, Wastewater), Fuel Handling | 21 |
| **Nitrous Oxide** | $N_2O$ | Combustion, Wastewater Treatment | 310 |
| **Hydrofluorocarbons** | Various | Leaked Refrigerants, Fire Suppressants | 12–11,700 |
| **Perfluorocarbons** | Various | Aluminum Production, Semiconductor Manufacturing, HVAC Equipment Manufacturing | 6,500–9,200 |
| **Sulfur Hexafluoride** | $SF_6$ | Transmission and Distribution of Power | 23,900 |

## Calculating Emissions

In general, emissions can be quantified in two ways.

**1. Measurement-based methodologies** refer to the direct measurement of greenhouse gas emissions from a monitoring system. Emissions measured this way may include those emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility. This method is the most accurate way of inventorying emissions from a given source, but is generally available for only a few sources of emissions.

**2. Calculation-based methodologies** refer to an estimate of emissions calculated based upon measurable ***activity data*** and ***emission factors***. Table 3 provides examples of common emissions calculations.

### Table 3: Basic Emissions Calculations

| Activity Data x | Emissions Factor = | Emissions |
|---|---|---|
| Electricity Consumption (kilowatt hours) | $CO_2$ emitted/kWh | $CO_2$ emitted |
| Natural Gas Consumption (therms) | $CO_2$ emitted/therm | $CO_2$ emitted |
| Gasoline/Diesel Consumption (gallons) | $CO_2$ emitted /gallon | $CO_2$ emitted |
| Waste Generated by Government Operations (tons) | $CH_4$ emitted/ton of waste | $CH_4$ emitted |

## The Scopes Framework

This inventory reports greenhouse gas emissions by sector and additionally by "scope", in line with the LGO Protocol and World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) Greenhouse Gas Emissions Protocol Corporate Standard.

Scope 1: Direct emissions from sources within a local government's operations that it owns and/or controls, with the exception of direct CO2 emissions from biogenic sources. This includes stationary combustion to produce electricity, steam, heat, and power equipment; mobile combustion of fuels; process emissions from physical or chemical processing; fugitive emissions that result from production, processing, transmission, storage and use of fuels; leaked refrigerants; and other sources.

Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.

Scope 3: All other emissions sources that hold policy relevance to the local government that can be measured and reported. This includes all indirect emissions not covered in Scope 2 that occur as a result of activities within the operations of the local government. Scope 3 emission sources include (but are not limited to) tailpipe emissions from employee commutes, employee business travel, and emissions resulting from the decomposition of government-generated solid waste.

ICLEI and the LGO Protocol provide standard methodologies for calculating emissions from the sources shown in the following table. Other sources of emissions, such as those associated with the production of consumed products do not yet have standard calculation methodologies and are thus excluded from this inventory.

### Table 4: Inventoried Emissions Sources by Scope

| Scope 1 | Scope 2 | Scope 3 |
|---|---|---|
| Fuel consumed at facilities | Purchased electricity consumed by facilities | Solid waste generated by government operations |
| Fuel consumed by vehicle fleet and mobile equipment | Purchased electricity consumed by electric vehicles | Fuel consumed by vehicles during employee commuting |
| Fuel consumed to generate electricity | Purchased steam | |
| Leaked refrigerants from facilities and vehicles | Purchased cooling (chilled water) | |
| Leaked / deployed fire suppressants | | |
| Solid waste in government landfills | | |
| Wastewater decomposition and treatment at a municipal wastewater treatment plant | | |

## Organizational Boundaries

The organizational boundary for the inventory determines which aspects of operations are included in the emissions inventory, and which are not. Under the LGO Protocol, two control approaches are used for reporting emissions: operational control or financial control. A local government has operational control over an operation if it has full authority to introduce and implement policies that impact the operation. A local government has financial control if the operation is fully consolidated in financial accounts. If a local government has joint control over an operation, the contractual agreement will have to be examined to see who has authority over operating policies and implementation, and thus the responsibility to report emissions under operational control.

LGO Protocol strongly encourages local governments to utilize operational control as the organization boundary for a government operations emissions inventory. Operational control is believed to most accurately represent the emissions sources that local governments can most directly influence, and this boundary is consistent with other environmental and air quality reporting program requirements. For this reason, this inventory was conducted according to the operational control framework.

## Types of Emissions

As described in the LGO Protocol, emissions from each of the greenhouse gases can come in a number of forms:

**Stationary or mobile combustion:** These are emissions resulting from on-site combustion of fuels (natural gas, diesel, gasoline, etc.) to generate heat, electricity, or to power vehicles and mobile equipment.

**Purchased electricity:** These are emissions produced by the generation of power from utilities outside of the jurisdiction.

**Fugitive emissions:** Emissions that result from the unintentional release of greenhouse gases into the atmosphere (e.g., leaked refrigerants, methane from waste decomposition, etc.).

**Process emissions:** Emissions from physical or chemical processing of a material (e.g., wastewater treatment).

## Significance Thresholds

Within any local government's own operations there will be emission sources that fall within Scope 1 and Scope 2 that are minimal in magnitude and difficult to accurately measure. Within the context of local government operations, emissions from leaked refrigerants and backup generators may be common sources of these types of emissions. For these less significant emissions sources, LGO Protocol specifies that up to 5 percent of total emissions can be reported using methodologies that deviate from the recommended methodologies in LGO Protocol. In the context of registering emissions with an independent registry (such as the California Climate Action Registry), emissions that fall under the significance threshold are called de minimis.

In this report, some emissions were calculated using methods that deviate from the methods recommended in the LGO Protocol. However, the LGO Protocol identifies several alternative methods that still meet emission calculation standards. For the following areas, alternative methods were used to calculate emissions:

- Scope 1 fugitive emissions from the leakage of refrigerants from stationary heating, air conditioning, and refrigeration units
- Scope 1 fugitive emissions from the leakage of refrigerants from vehicles in the vehicle fleet
- Scope 2 $CO_2$ emissions from the generation of electricity purchased to power facilities

In addition, emissions data from the following sources could not be obtained for this report and therefore emissions from these sources are not included in this inventory:

- Scope 1 $CH_4$ and $N_2O$ emissions from mobile fuel combustion in vehicle fleet and mobile equipment
- Scope 1 fugitive emissions from the leakage fire suppressants used by the city
- Scope 1 $CO_2$, $CH_4$ and $N_2O$ emissions from the combustion of fossil fuels to power buildings and facilities (including back-up generators)

Finally, emissions could not be calculated for electricity provided by Turlock Irrigation District used to power streetlights (Scope 2). This portion of streetlights was not metered in 2005, so emissions could not be recorded for this division of the Public Lighting sub-sector. However, cost information was available, which may provide a frame of reference for the proportion of activity occurring in this operation.

## Information Items

Information items are emissions sources that are not included as Scope 1, 2, or 3 emissions in the inventory, but are reported here separately in order to provide a more complete picture of emissions from City of Hughson's government operations.

A common emission that is categorized as an information item is carbon dioxide emitted in the combustion of biogenic fuels. Local governments will often burn fuels that are of biogenic origin (wood, landfill gas, organic solid waste, biofuels, etc.) to generate power. Common sources of biogenic emissions are the combustion of landfill gas from landfills or biogas from wastewater treatment plants, as well as the incineration of organic municipal solid waste at incinerators.

Carbon dioxide emissions from the combustion of biogenic fuels are not included in Scope 1 based on established international principles. Methane and nitrous oxide emissions from biogenic fuels are considered Scope 1 stationary combustion emissions and are included in the stationary combustion sections for the appropriate facilities. These principles indicate that biogenic fuels (e.g., wood, biodiesel), if left to decompose in the natural environment, would release CO2 into the atmosphere, where it would then enter back into the natural carbon cycle. Therefore, when wood or another biogenic fuel is combusted, the resulting CO2 emissions are akin to natural emissions and should therefore not be considered as human activity-generated emissions. The CH4 and N2O emissions, however, would not have occurred naturally and are therefore included as Scope 1 emissions.

Information items quantified for this inventory include:

- Scope 1 emissions from ozone depleting chemical used as refrigerants in the vehicle fleet
- Scope 1 emissions from ozone depleting chemical used as refrigerants in air conditioning and refrigeration equipment

| INFORMATION ITEMS | $CO_2e$ |
|---|---|
| Facility AC & Refrigerant R-22 Fugitive Emissions | 8.397 |
| Vehicle Fleet R-12 Fugitive Emissions | 0.004 |
| Total Information Items | 8.401 |

## Understanding Totals

It is important to realize that the totals and sub-totals listed in the tables and discussed in this report are intended to represent all-inclusive, complete totals for City of Hughson's operations. However, these totals are only a summation of inventoried emissions using available estimation methods. Each inventoried sector may have additional emissions sources associated with them that were unaccounted for, such as Scope 3 sources that could not be estimated.

Also, local governments provide different services to their citizens, and the scale of the services (and thus the emissions) is highly dependent upon the size and purview of the local government. For these reasons, comparisons between local government totals should not be made without keen analysis of the basis for figures and the services provided.

It is important to understand that in the case where a local government operates a municipal utility that generates electricity for government facilities, the associated emissions should be considered Scope 1 emissions within the Power Generation Facilities sector, and not Scope 2 emissions within each of the other facilities sectors, when calculating a total. This is advised by the LGO Protocol and done to avoid reporting the same emissions twice, also known as double counting.

# Inventory Results

## Emissions Total

In 2005, City of Hughson's greenhouse gas emissions from government operations totaled 1,270 metric tons of CO2e. This number represents a roll-up of emissions. While the roll-up is a valuable figure, information on the breakdown of emissions from local government operations by scopes, sources, and sectors allows the comparative analysis and insight needed for effective decision-making on target setting, developing GHG reduction measures, or monitoring. The LGO Protocol and ICLEI identify reporting by scopes, sources, and sectors as the strongly preferred form of reporting a greenhouse gas inventory. For more details on the breakdown of City of Hughson's emissions by scopes, sources, and sectors, refer to subsequent sections within Inventory Results in this report.

## Buildings and Other Facilities

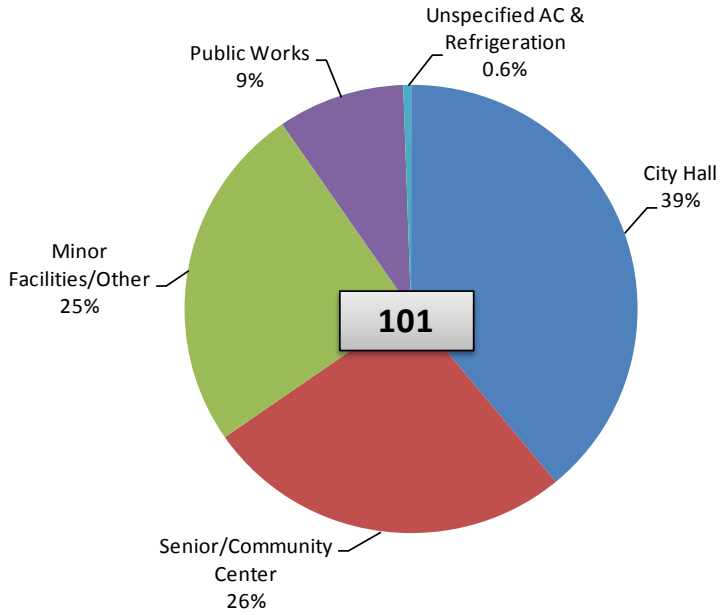
Facility operations contribute to greenhouse gas emissions in two major ways. First, facilities consume electricity and fuels such as natural gas. This consumption is associated with the majority of greenhouse gas emissions from facilities. In addition, fire suppression, air conditioning, and refrigeration equipment in buildings can emit hydrofluorocarbons (HFCs) and other greenhouse gases when these systems leak refrigerants or fire suppressants. Refrigerants and fire suppressants are very potent greenhouse gases, and have Global Warming Potential (GWP) of up to many thousand times that of CO2. For example, HFC-134a, a very common refrigerant, has a GWP of 1300, or 1300 times that of CO2. Therefore, even small amounts of leaked refrigerants can have a significant effect on greenhouse gas emissions.

City of Hughson operated four facilities in 2005, with operations ranging from general government, to public works and community facilities. For the purpose of reporting emissions, these facilities were grouped by department when possible. Facilities that where unknown or previously uncategorized were included in this section of the inventory under the category, "Minor Facilities/Other." In one case, park lighting and sprinkler control electricity consumption were both recorded on the same meter. Since this data could not be disaggregated, the activity was included in the "Minor Facilities/Other" category as well. Data relating to natural gas consumption were obtained from PG&E. Data relating to electricity consumption were obtained from Turlock Irrigation District. Data relating to refrigerant leakage were obtained from the Public Works Department.

The Buildings and Facilities sector produced the fourth-largest amount of emissions by sector. Overall, these facilities produced 101 metric tons of CO2e (8% of total emissions). As illustrated in Figure 3, the facility group producing the most greenhouse gas emissions in the City of Hughson is City Hall at 39%. The second largest contributor is the Senior/Community Center (located at 2307 4th Street) at 26%. As illustrated in Figure 4, the source producing the most

greenhouse gas emissions in the Buildings and Facilities sector is purchased electricity at 81%, followed by natural gas at 18%, and various air conditioning/refrigeration equipment at less than 1%.

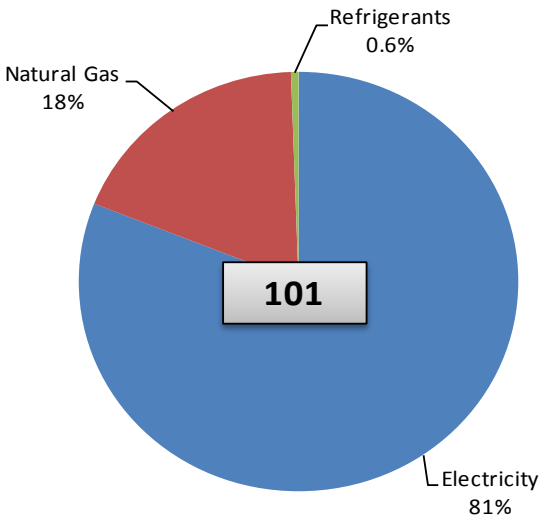
## Figure 3: Buildings and Other Facilities Emissions by Department




## Table 5: Buildings and Other Facilities Emissions by Department

| Department | metric tons $CO_2e$ |
|---|---|
| City Hall | 39.29 |
| Senior/Community Center | 26.55 |
| Minor Facilities/Other | 25.26 |
| Public Works | 9.15 |
| Unspecified AC & Refrigeration | 0.56 |
| **Totals** | **101** |

## Figure 4: Buildings and Other Facilities Emissions by Source




## Table 6: Buildings and Other Facilities Emissions by Source

| Source | metric tons $CO_2e$ |
|---|---|
| Electricity | 81.70 |
| Natural Gas | 18.54 |
| Refrigerants | 0.56 |
| **Totals** | **101** |

## Figure 5: Top 5 Largest Contributors to Emissions from Buildings Sector

| Facility | % of Five Largest Contributors Total Emissions from Electricity | % of Five Largest Contributors Total Emissions from Natural Gas | % of Five Largest Contributors Total Emissions from Other Sources | $CO_2e$ Emissions from Electricity | $CO_2e$ Emissions from Natural Gas | $CO_2e$ Emissions from Other Sources | Total $CO_2e$ Emissions |
|---|---|---|---|---|---|---|---|
| City Hall | 32% | 6% | - | 32.74 | 6.55 | - | 39 |
| Senior/Community Center | 21% | 5% | - | 21.66 | 4.89 | - | 27 |
| Minor Facilities/Other | 21% | 4% | - | 21.58 | 3.68 | - | 25 |
| Public Works | 6% | 3% | - | 5.72 | 3.43 | - | 9 |
| Unspecified AC & Refrigeration | 0% | - | 1% | - | - | 0.56 | 1 |
| **Totals** | **81%** | **18%** | **1%** | **82** | **19** | **1** | **101** |

## Table 7: LGO Protocol Report - Buildings Sector Emissions by Scope and Emission Type

| BUILDINGS & OTHER FACILITIES | | | | | | |
|---|---|---|---|---|---|---|
| **Scope** | **Emission Type** | **Greenhouse Gas Emissions (metric tons)** | | | | |
| **SCOPE 1** | | $CO_2e$ | $CO_2$ | $CH_4$ | $N_2O$ | HFCs |
| | Stationary Combustion | 18.541 | 18.493 | 0.002 | 0.000 | - |
| | Fugitive Emissions | 0.556 | - | - | - | 0.000 |
| | **Total Direct Emissions** | **19.097** | **18.493** | **0.002** | **0.000** | **0.000** |
| **SCOPE 2** | | $CO_2e$ | $CO_2$ | $CH_4$ | $N_2O$ | |
| | Purchased Electricity | 81.702 | 81.356 | 0.003 | 0.001 | |
| | **Total Indirect Emissions** | **81.702** | **81.356** | **0.003** | **0.001** | |
| **INDICATORS** | Number of Employees | 14 | | | | |

## Streetlights, Traffic Signals, and Other Public Lighting

Like most local governments, City of Hughson operates public lighting, including 324 street and sidewalk lights. The majority of emissions associated with the operation of this infrastructure are due to electricity consumption. Data relating to electricity consumption for public lighting were obtained from Turlock Irrigation District. Some streetlights are owned by the City of Hughson, while others are owned by Turlock Irrigation District. Unfortunately, though, the consumption of electricity by streetlights in the City of Hughson was not metered in 2005. Thus, a calculation of the emissions from this sector could not be completed. Nonetheless, cost information is available for those streetlights that the city owned, for which Turlock Irrigation District provided power. In 2005, the City of Hughson spent $25,249 to operate streetlights for residents.

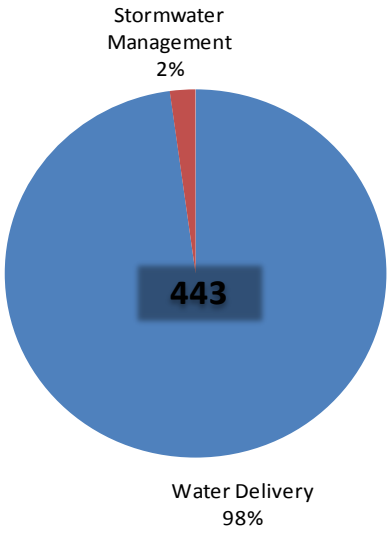
## Water Delivery Facilities

This sector includes emissions from equipment used for the distribution or transport of water, including drinking water, sprinkler systems and irrigation. City of Hughson operates a range of water transport equipment, including water wells, water pumps and stormwater management infrastructure. Electricity consumption is a significant source of greenhouse gas emissions from the operation of City of Hughson's water transport equipment. Data relating to electricity consumption were obtained from Turlock Irrigation District.

Note: this sector of the inventory does not include the park sprinkler control which could not be disaggregated from the multipurpose park light and sprinkler control record.

The Water Transport sector produced the largest amount of emissions overall, with 443 metric tons of CO2e (35% of total emissions). As illustrated in Figure 6, the subsector producing the most greenhouse gas emissions in the Water Transport sector is water delivery at 98%, followed by stormwater management at 2%.

### Figure 6: Water Delivery Facilities Emissions by Subsector



## Table 8: Water Delivery Facilities Emissions by Subsector

| Subsector (Equipment Type) | metric tons $CO_2e$ | % of Sector Emissions | Electricity Use (kWh) | Cost ($) |
|---|---|---|---|---|
| Water Delivery | 433.62 | 98% | 1,003,855 | $ 63,485 |
| Stormwater Management | 9.58 | 2% | 22,175 | $ 2,879 |
| **Totals** | **443** | **100%** | **1,026,030** | **$ 66,364** |

## Table 9: LGO Protocol Report - Water Delivery Facilities Emissions by Scope and Emission Type

| WATER TRANSPORT FACILITIES | | | | | |
|---|---|---|---|---|---|
| **Scope** | **Emission Type** | **Greenhouse Gas Emissions (metric tons)** | | | |
| **SCOPE 2** | | $CO_2e$ | $CO_2$ | $CH_4$ | $N_2O$ |
| | Purchased Electricity | 443.195 | 441.315 | 0.014 | 0.005 |
| | **Total Indirect Emissions** | **443.195** | **441.315** | **0.014** | **0.005** |

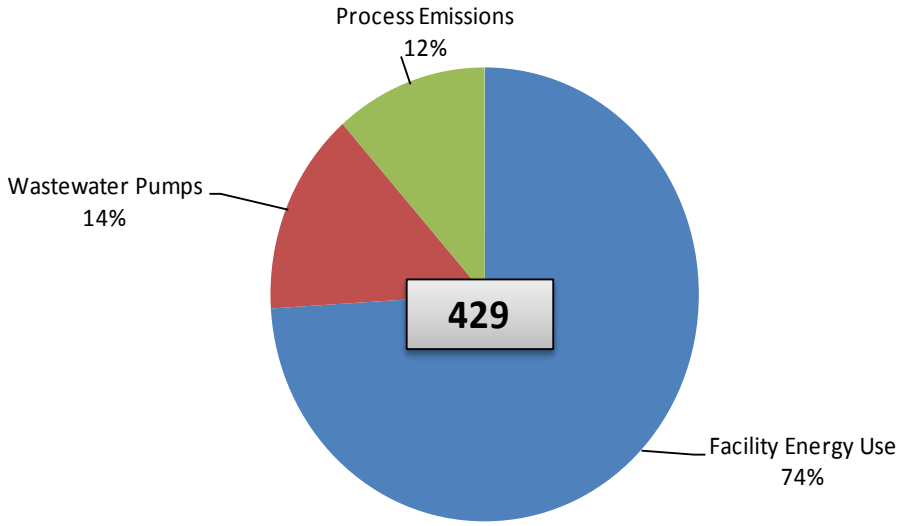
## Wastewater Treatment Facilities

Wastewater coming from homes and businesses is rich in organic matter and has a high concentration of carbon and nitrogen (along with other organic elements). As wastewater is collected, treated, and discharged, chemical processes in aerobic and anaerobic conditions lead to the creation and emission of two greenhouse gases: methane and nitrous oxide. Local governments that operate wastewater treatment facilities, including treatment plants, septic systems, collection lagoons, and other facilities, must therefore account for the emission of these gases.

City of Hughson operates the wastewater treatment plant at 6700 Leedom Road, which processes up to 830,000 gallons per day on average. In addition, there are several sewer pumps stationed throughout the city, on Tully Road/Whitmore Avenue, on 7th Street/De Forest Court, and on Hatch Road. These facilities serve approximately 5,000 people, including businesses and industries located within the jurisdiction.

The Wastewater Treatment sector produced the second-largest amount of emissions in this inventory. Overall, these facilities produced 429 metric tons of $CO_2e$ (34% of total emissions). As illustrated in Figure 7, the subsector producing the most greenhouse gas emissions in the Wastewater Treatment sector is aggregate energy use at 6700 Leedom Road at 74%, followed by wastewater pumps at 14%, and wastewater treatment process emissions at 12%.

### Figure 7: Wastewater Treatment Facilities Emissions by Subsector




### Table 10: Wastewater Treatment Facilities Emissions by Subsector

| Subsector | metric tons $CO_2e$ |
|---|---|
| Facility Energy Use | 317.23 |
| Wastewater Pumps | 61.95 |
| Process Emissions | 49.38 |
| **Totals** | **429** |

## Table 11: LGO Protocol Report - Wastewater Treatment Facilities Emissions by Scope and Emission Type

| WASTEWATER TREATMENT FACILITIES | | | | | |
|---|---|---|---|---|---|
| **Scope** | **Emission Type** | **Greenhouse Gas Emissions (metric tons)** | | | |
| **SCOPE 1** | | $CO_2e$ | $CO_2$ | $CH_4$ | $N_2O$ |
| | Process Emissions | 49.383 | - | - | 0.159 |
| | **Total Direct Emissions** | **49.383** | **0.000** | **0.000** | **0.159** |
| **SCOPE 2** | | $CO_2e$ | $CO_2$ | $CH_4$ | $N_2O$ |
| | Purchased Electricity | 379.173 | 377.564 | 0.012 | 0.004 |
| | **Total Indirect Emissions** | **379.173** | **377.564** | **0.012** | **0.004** |
| **INDICATORS** | Gallons of Wastewater Treated | 9 MGD | | | |

## Vehicle Fleet and Mobile Equipment

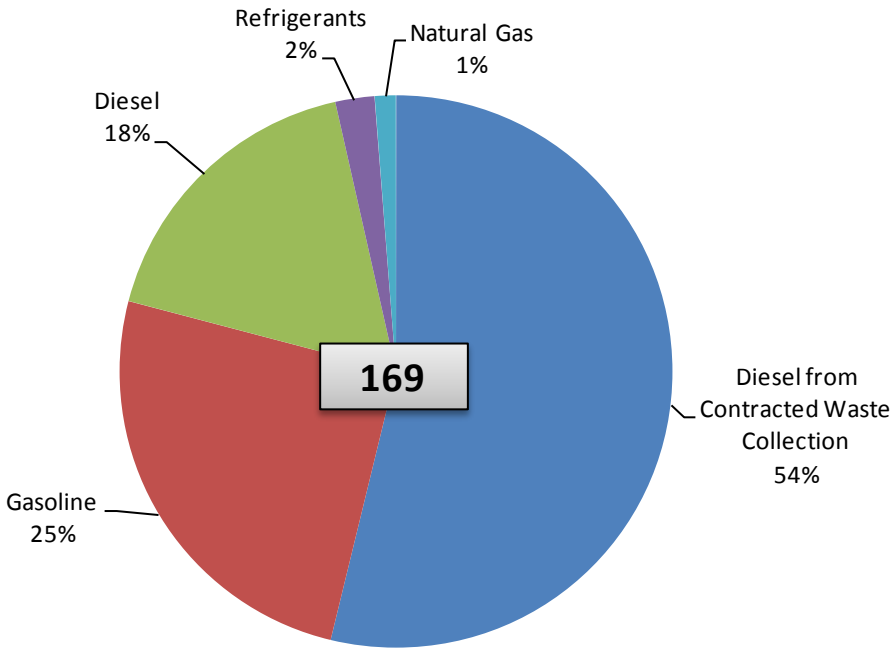
The vehicles and mobile equipment used in City of Hughson's daily operations burn gasoline, diesel, and compressed natural gas (CNG), each of which results in greenhouse gas emissions. In addition, vehicles with air conditioning or refrigeration equipment use refrigerants that can leak from the vehicle. Emissions from vehicles used in contracted services are also included in this sector.

The emissions resulting from the consumption of fossil fuels by the City of Hughson's contracted waste hauler were reported within this sector as Scope 3 emissions. This is due to the fact that the City of Hughson does not have operational or financial control over this particular vehicle fleet *(refer to Organizational Boundaries)*. However, the LGO Protocol recommends that, if available, this Scope 3 emission be reported for the sake of transparency and policy relevance.

While refrigerants are estimated to have contributed 3.87 metric tons of $CO_2e$ (0.14% of total emissions), it should be noted that the default method was used to estimate emissions from leaked refrigerants. While this method can significantly overestimate the actual amount of leaked refrigerant, this method is in line with LGO Protocol methods. The figure generated here is a conservative amount in lieu of exact amounts, which were not available. The default method and other methods will be discussed in greater detail in the "Inventory Methodologies" section. Emissions from ozone depleting chemicals used as refrigerants in vehicles produced before 1995 (e.g. R-12) were included as an information item in this inventory since these chemicals are regulated by the Montreal Protocol and are currently being phased out of use.

The Vehicle Fleet sector produced the third-largest amount of emissions in this inventory. Overall, this sector produced 169 metric tons of $CO_2e$ (13% of total emissions). As illustrated in Figure 8, the source producing the most greenhouse gas emissions in the Vehicle Fleet sector is the Scope 3 emissions from mobile combustion of diesel resulting from the city's contracted waste hauling operations (54%). The source producing the most greenhouse gas emissions as a direct result of the city's vehicle fleet operations is gasoline at 25%, followed diesel at 18%.

## Figure 8: Vehicle Fleet Emissions by Source




## Table 12: Vehicle Fleet Emissions by Source

| Source | metric tons $CO_2e$ | Consumption | Cost ($) |
|---|---|---|---|
| Diesel from Contracted Waste Collection | 90.96 | 8,900 (gal) | - |
| Gasoline | 42.80 | 4,875 (gal) | 10,433 |
| Diesel | 29.36 | 2,876 (gal) | 6,902 |
| Refrigerants | 3.87 | 3 (kg) | - |
| Natural Gas | 2.10 | 377 (thm) | 637 |
| **Totals** | **169** | | **17,972** |

## Table 13: LGO Protocol Report - Vehicle Fleet Emissions by Scope and Emission Type

| VEHICLE FLEET | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Scope** | **Emission Type** | **Greenhouse Gas Emissions (metric tons)** | | | | | |
| **SCOPE 1** | | $CO_2e$ | $CO_2$ | $CH_4$ | $N_2O$ | HFCs | |
| | Mobile Combustion | 165.220 | 165.016 | 0.003 | 0.000 | - | |
| | Fugitive Emissions | 3.871 | - | - | - | 0.003 | |
| | **Total Direct Emissions** | **169.091** | **165.016** | **0.003** | **0.000** | **0.003** | |
| **INDICATORS** | Number of Vehicles | 12 | | | | | |
| | Number of Pieces of Equipment | 6 | | | | | |

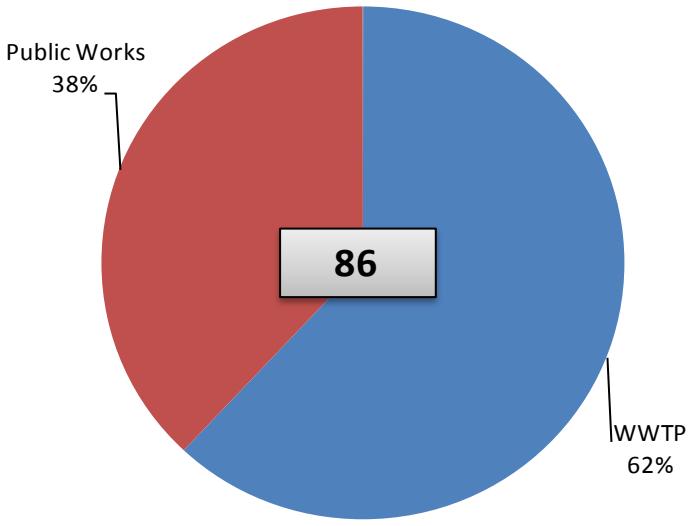
FIGARO'S PIZZA
NO PARKING

## Government-Generated Solid Waste

Many local government operations generate solid waste, much of which is eventually sent to a landfill. Typical sources of waste in local government operations include paper and food waste from offices and facilities, construction waste from public works, and plant debris from parks departments. Organic materials in government-generated solid waste (including paper, food scraps, plant debris, textiles, wood waste, etc.) generate methane as they decay in the anaerobic environment of a landfill. Emissions from the waste sector are an estimate of methane generation that will result from the anaerobic decomposition of all organic waste sent to landfill in the base year. It is important to note that although these emissions are attributed to the inventory year in which the waste is generated, the emissions themselves will occur over the 100+ year timeframe that the waste will decompose.

Solid waste data was available for two operations in the year 2005: general Public Works operations, and the wastewater treatment sludge drop box. The Solid Waste sector produced the fifth-largest amount of emissions in this inventory. Overall, this sector produced 86 metric tons of CO2e (7% of total emissions). As illustrated in Figure 9, the operation producing the most greenhouse gas emissions in the Solid Waste sector is the waste from the wastewater treatment plant at 62%, followed by public works operations at 38%.

### Figure 9: Government Waste Emissions by Subsector




### Table 14: Government Waste Emissions by Subsector

| Department | metric tons $CO_2e$ |
|---|---|
| WWTP | 53.41 |
| Public Works | 32.77 |
| **Totals** | **86** |

## Table 15: LGO Protocol Report - Government Waste Emissions by Scope and Emission Type

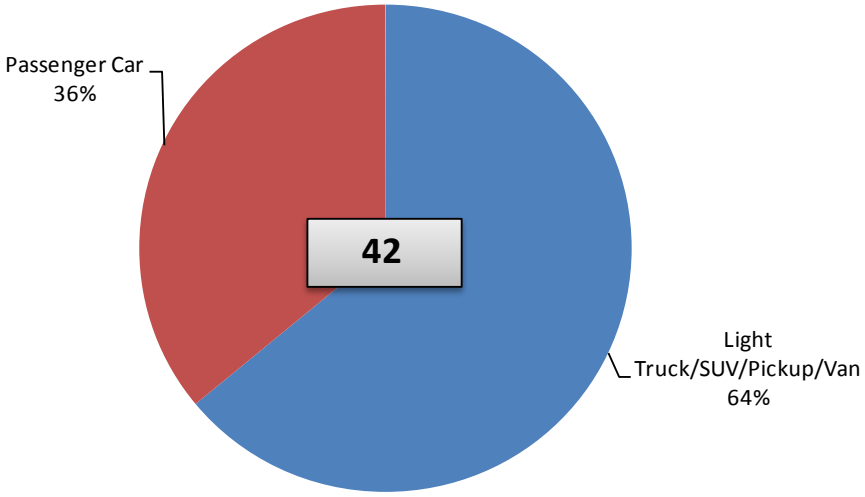
| SOLID WASTE GENERATION | | |
|---|---|---|
| **Scope** | **Emission Type** | **Greenhouse Gas Emissions (metric tons)** |
| **SCOPE 3** | | $CO_2e$ |
| | Waste All Facilities | 86.177 |
| **INDICATORS** | Short tons of solid waste | 339.8 |

## Employee Commute

Emissions in the Employee Commute sector are due to combustion of fuels in vehicles used by government employees for commuting to work at City of Hughson. Results from a survey designed by ICLEI and administered by City of Hughson are shown below. The survey was used to collect the data needed to calculate emissions and also capture other information that will help City of Hughson set effective policy addressing this sector.

The Employee Commute sector produced the sixth-largest amount of emissions in this inventory. Overall, this sector produced 42 metric tons of $CO_2e$ (3% of total emissions). As illustrated in Figure 10, the vehicle class producing the most greenhouse gas emissions in the sector is the light truck/SUV/pickup/van category at 64%, followed by passenger cars at 36%. Nearly all vehicles are fueled by gasoline, with only a few using diesel.

### Figure 10: Employee Commute Emissions by Vehicle Class




### Table 16: Employee Commute Emissions by Vehicle Class

| Vehicle Class | metric tons $CO_2e$ |
|---|---|
| Light Truck/SUV/Pickup/Van | 26.78 |
| Passenger Car | 15.07 |
| **Totals** | **42** |

## Table 17: LGO Protocol Report - Employee Commute Emissions by Scope and Emission Type

| EMPLOYEE COMMUTE | | |
|---|---|---|
| **Scope** | **Emission Type** | **Greenhouse Gas Emissions (metric tons)** |
| **SCOPE 3** | | $CO_2e$ |
| | Mobile Combustion | 41.849 |
| **INDICATORS** | Vehicle Miles Traveled | 77,564 |

## Table 18: Employee Commute - Reasons for Not Carpooling Data

| Reason | Percentage |
|---|---|
| Other people do not match my schedule or route | 3% |
| Difficult to find others to carpool/vanpool | 20% |
| Work late or irregular hours | 13% |
| May not be able to get home quickly in an emergency | 13% |
| Like the privacy when I'm in my own car | 13% |
| Dislike being dependent on others | 3% |
| Need my car on the job | 13% |
| Need to make stops on the way to work or home | 3% |
| Makes my trip too long | 10% |
| I don't know enough about carpooling or vanpooling | 3% |
| Never considered carpooling or vanpooling | 3% |
| Other | 0% |

## Table 19: Employee Commute - Reasons for Not Taking Transit

| Reason | Percentage |
|---|---|
| Transit service doesn't match my route or schedule | 0% |
| It costs too much | 23% |
| It takes too long | 4% |
| It is not safe or easy to walk to work from the transit stop | 12% |
| Not enough parking at the transit stop from which I'd depart | 4% |
| It is too far to walk to work from the transit stop | 0% |
| I work late or irregular hours | 0% |
| May not be able to get home quickly during an emergency | 8% |
| Like the privacy when I'm in my own car | 12% |
| Need my car on the job | 12% |
| Need to make stops on the way to work or home | 4% |
| I don't know enough about taking transit | 15% |
| Never considered using public transit | 4% |
| Other | 4% |

## Table 20: Employee Commute - Reasons for Not Walking/Biking

| Reason | Percentage |
|---|---|
| I live too far away | 0% |
| There isn't a safe or easy route for walking or biking | 29% |
| Weather | 14% |
| No place at work to store bikes safely | 14% |
| It's not easy to look good and feel comfortable for work after walking or biking | 0% |
| Workplace does not have adequate facilities for showering/changing | 10% |
| May not be able to get home quickly in an emergency | 5% |
| Need to make stops on the way to work or home | 19% |
| Never considered walking or biking to work | 5% |
| I don't know enough about walking or biking to work | 5% |
| Other | 0% |

## Table 21: Employee Commute - Travel Mode Data

| Mode | Percentage |
|---|---|
| Drive Alone | 85% |
| Carpooling/Vanpooling | 0% |
| Public Transportation | 0% |
| Bicycling | 0% |
| Walking | 0% |
| Telecommute/Other | 0% |
| Split Modes | 15% |

## Table 22: Employee Commute - Miles from Work Data

| Miles | Percentage |
|---|---|
| 0-5 | 31% |
| 6-10 | 31% |
| 11-15 | 23% |
| 15-20 | 8% |
| 21-25 | 0% |
| 26-30 | 8% |
| 31-35 | 0% |
| 36-40 | 0% |
| 41-45 | 0% |
| 46-50 | 0% |
| 51-75 | 0% |
| 76-100 | 0% |
| Over 100 | 0% |

## Table 23: Employee Commute - Time to Work Data

| Time | Percentage |
|---|---|
| Less than 5 | 22% |
| 6 to 15 | 11% |
| 16 to 25 | 44% |
| 26 to 35 | 11% |
| 36 to 44 | 11% |
| 45 or more | 0% |

WELCOME TO...
HUGHSON

# Inventory Methodologies

ICLEI's Clean Air & Climate Protection Software (CACP 2009) software made it possible to calculate greenhouse gas emissions for the following greenhouse gases: Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride. Activity data was collected for a number of activities through a number of methods. Activity data was stored in Master Data Workbook (MDWB), which serves as a tool for organizing and conditioning data, and, in some cases, calculating emissions. Data collection methods range from LGO Protocol-recommended, to LGO Protocol-alternative and non-LGO Protocol alternatives. The methods used depend on the availability and format of data. Inputting activity data into CACP 2009, along with the correct emission factor, resulted in the calculation of greenhouse gas emissions for the City of Hughson's 2005 government operations.

## Buildings and Other Facilities

Activity data for the Buildings and Facilities sector can be collected in two ways: using utility records, or internal records. First, with the approval of the city, natural gas usage records were released by PG&E and electricity usage records were released by Turlock Irrigation District for the year 2005. These records indicated the natural gas usage in therms and the electricity usage in kilowatt hours (kWh), as well as cost in dollars ($) and a description of the activity. The data were then categorized by activity and, if possible, by facility and department. This method was effective in most cases. However, in some cases the description of the activity in the record was either too vague to categorize, or did not belong to any larger category, such as "police stations" or "parks." For instance, park lighting and sprinkler control electricity consumption were both recorded on the same meter, and thus could not be categorized in their respective sectors. These types of records were included under "Minor Facilities Aggregate Reporting." In addition, the categorization of data would have been more accurate if these utility records were cross-referenced with departmental utility bill records, which were not available at the time of the inventory.

The emission factor for $CO_2$ emissions resulting from the generation of electricity by Turlock Irrigation District in 2005 was not available. However, the California Air Resources Board (CARB) California Grid Average for 2005 was available and was used as a basis for calculation. Thus, calculation of this particular emission deviated from LGO recommended methods. Nonetheless, the method used to calculate emissions was an LGO approved alternative method, albeit less accurate. Calculations for $CH_4$ and $N_2O$ emissions from purchased electricity relied on emission factors recommended by the LGO Protocol.

Not all activity data was collected for the Buildings and Facilities sector. Specifically, data regarding data for refrigerants used in air conditioners and refrigeration units was not collected in full. While the city was able to provide a full

inventory of air conditioning and refrigeration equipment, there was not adequate information to determine actual leakage rates from the equipment. However, Master Data Workbook (MDWB) includes several resources, including standard leakage rates from different types of equipment. Unfortunately, specifications regarding the capacity of refrigerant inside the equipment could not be determined for all equipment in the inventory. Thus, Scope 1 fugitive emissions from the Buildings and Facilities sector are only accounted for in part. The emissions in this portion of the inventory are underestimated. The method used in this estimate is an LGO Protocol approved method, albeit less accurate than the recommended method, the Mass Balance Method. To use the Mass Balance Method, the following activity data must be collected: the type of refrigerant used in each unit; the capacity of refrigerant contained in each unit; and the amount of refrigerant recharged, recycled, or retired into/from each unit.

## Streetlights, Traffic Signals, and Other Public Lighting

Activity data for the Public Lighting sector were collected in the same way as those of the Buildings and Facilities sector. Utility records from Turlock Irrigation District were obtained and sorted by activity. Unfortunately, the records for public lighting activity could not be relied upon to calculate emissions. Specifically, the consumption of electricity by streetlights in the City of Hughson was not metered in 2005. Thus, Scope 2 emissions from purchased electricity used to power streetlights could not be determined. Nonetheless, cost information is available for those streetlights that the city owned, for which Turlock Irrigation District provided power.

Park lighting electricity consumption records existed and were provided by Turlock Irrigation District. However, these records also included park sprinkler controllers. Since the data could not be disaggregated, they were included as a minor facility in the Buildings and Facilities sector. Emissions from park lighting could not be determined for this sector.

## Water Transport Facilities

Activity data for the Water Transport sector were collected in the same way as those of the preceding two sectors. Utility records from Turlock Irrigation District identified electricity usage by quantity, cost, and activity. No natural gas was used to power water transport operations. Once again, the data were categorized by activity (e.g. water delivery, stormwater management). This method was effective in most cases. However, electricity consumption records for park lighting and sprinkler control were recorded together. Since the data could not be disaggregated, they were included as a minor facility in the Buildings and Facilities sector. Emissions from electricity used to power sprinkler controllers could not be determined for this sector.

Once again, the emission factor for $CO_2$ emissions resulting from the generation of electricity by Turlock Irrigation District in 2005 was not available. However, the California Air Resources Board (CARB) California Grid Average for 2005 was available and was used as a basis for calculation. Calculations for $CH_4$ and $N_2O$ emissions from purchased electricity relied on emission factors recommended by the LGO Protocol. Emissions from Scope 1 stationary combustion were calculated using pre-set emission factors in CACP 2009, which were taken from the LGO Protocol.

Not all activity data were collected for the Water Transport sector. Specifically, data regarding fuel consumption by backup generators used to power water transport infrastructure could not be collected. The city assigned six generators to various water wells throughout the city. The only activity data collected for these generators was in the form of operating hours. The quantity of fuel consumed during these operating hours could not be determined. Therefore, Scope 1 stationary combustion from fuels used to power backup generators was omitted from this inventory.

## Wastewater Treatment Facilities

Scope 2 activity data for the Wastewater Treatment sector were collected in the same way as those of the preceding sectors. Utility records from Turlock Irrigation District identified electricity usage by quantity, cost, and activity. No natural gas was used to power wastewater treatment operations. Once again, the data were categorized by activity (e.g. wastewater facilities, wastewater pumps). This method was effective in most cases. However, the categorization of data would have been more accurate if these utility records were cross-referenced with departmental utility bill records, which were not available at the time of the inventory.

Once again, the emission factor for $CO_2$ emissions resulting from the generation of electricity by Turlock Irrigation District in 2005 was not available. However, the California Air Resources Board (CARB) California Grid Average for 2005 was available and was used as a basis for calculation. Calculations for $CH_4$ and $N_2O$ emissions from purchased electricity relied on emission factors recommended by the LGO Protocol.

Scope 1 process emission data relied on site-specific measurements to calculate the $N_2O$ process emissions resulting from the treatment of wastewater at the centralized treatment plant at 6700 Leedom Road. The key variable in this calculation was the capacity of the facility. The Public Works Superintendant confirmed the capacity of the facility in terms of population served during the inventory year. Using equations developed for the LGO Protocol, this variable, along with several pre-set variables within the MDWB, was used to calculate an estimated emission figure resulting from the wastewater treatment process in 2005.

Not all activity data were collected for the Wastewater sector. Specifically, data regarding fuel consumption by backup generators used to power pumps and other facilities could not be collected. The only activity data collected for these generators was in the form of operating hours. The quantity of fuel consumed during these operating hours could not be determined. Therefore, Scope 1 stationary combustion from fuels used to power backup generators was omitted from this inventory.

## Vehicle Fleet and Mobile Equipment

There are three types of activity data to be collected in an inventory of Vehicle Fleet and Mobile Equipment emissions: the quantity and type of fuel consumed, which primarily determines the magnitude of $CO_2$ emissions; vehicle miles travelled (VMT), which determines the magnitude of $CH_4$ and $N_2O$ emissions at varying rates depending on the vehicle and fuel type; and refrigerant leakage from air conditioning units within vehicles. Each of these activity data have

corresponding emission factors pre-set in CACP 2009, which are taken from the LGO Protocol. Thus, the activity data need only be collected and conditioned, and then entered into CACP 2009 to calculate emissions from Scope 1 mobile combustion, Scope 1 fugitive emissions, and Scope 3 mobile combustion of fuels used by contracted service-providers.

Of the three types of activity data required for estimating emissions in this sector, only fuel consumption was acquired. Fuel consumption by the City of Hughson's vehicle fleet was determined based on aggregate fuel consumption records provided by the city. Records indicated aggregate consumption of gasoline, diesel and CNG. Based on this information, CACP 2009 was able to determine the magnitude of $CO_2$ emissions from the vehicle fleet sector. While this aggregate fuel consumption method is an LGO Protocol approved alternative method, the recommended method is to identify annual fuel consumption and cost by each vehicle by fuel type and department. It is recommended that the city track fuel consumption per vehicle in order to improve the accuracy of mobile source emissions estimates in the future. In addition, it is recommended that the city track fuel cost in order to make the information in this sector more transparent and policy-relevant.

Note: Since fossil fuel consumption was identified by the City of Hughson in aggregate and reported in the Vehicle Fleet sector, it is possible that a portion of these fuels were used in the facilities sectors (e.g. fuel for backup generators used in Buildings and Facilities, Water Delivery, Wastewater Treatment, etc.). Thus, with respect to fuel consumption, it should be noted that the emissions in this sector may be overestimated, while the emissions from the facilities sectors may be underestimated.

In addition, fuel consumption was collected for Scope 3 emissions resulting from contracted services (waste-hauling trucks owned by the contracted agency, but resulting in emissions within the jurisdiction as a result of government operations). First, with the approval of the city, records were released by Waste Management for waste-hauling fuel consumed on behalf of the City of Hughson. Data was provided in aggregate, and was entered into CACP 2009 under the "Heavy Duty" vehicle type in order to estimate $CO_2$, $CH_4$ and $N_2O$ emissions from mobile combustion. While waste-hauling fuel consumption was available, the total cost was not available.

Vehicle miles travelled (VMT) could not be determined for the City of Hughson's vehicle fleet operations in 2005. Thus, the magnitude of $CH_4$ and $N_2O$ emissions by the City of Hughson's vehicle fleet could not be determined either. It is recommended that the city track VMT per vehicle in order to improve the accuracy of mobile source emissions estimates in the future.

Mobile source refrigerant activity data was acquired through an analysis of the vehicle fleet inventory list provided by the city. Once all vehicles were identified by model, make, and year, the refrigerant level was estimated based on a database of vehicle refrigerant full-charge levels. Because the full-charge levels were assumed, this portion of the emissions inventory in this sector may be overestimated. This database included vehicle model years ranging from 1984 through 2004, specifications could not be determined for vehicles in the inventory with model years before 1985 or after 2004. In other cases, the vehicle type could not be referenced in the database. Thus, there several vehicles unaccounted for in

this inventory. Based on the full-charge levels assigned to each vehicle, a standard leakage-rate was applied to each vehicle based on default figures listed in the LGO Protocol. These default figures may also result in overestimation of emissions in this sector. While fugitive emissions were estimated based on the LGO Protocol approved alternative method above, the recommended method is to apply the Mass Balance Method. This method requires the city to track the type and amount of refrigerant in storage at the beginning and end of the year, and the amount purchased and disposed or recycled throughout the year.

## Government-Generated Solid Waste

Government-Generated solid waste is considered a scope 3 emissions source and is therefore not required by the Local Government Operations Protocol. However, ICLEI stresses that waste generation is an important part of any government operations inventory and includes it as recommended source in its ICLEI Reporting Standards for Greenhouse Gas Operations. According to ICLEI, to calculate emissions based on the decomposition of government generated solid waste sent to landfill, the following activity data must be collected: the amount of waste produced by government operations and the percentage of waste sent to landfill. In addition, ICLEI recommends that these data be collected by department and/or division. The following activity data are optional: the costs associated with waste disposal; the quantity of containers per facility or waste group; and the volumetric capacity of the containers per facility or waste group.

The City of Hughson solid waste records were obtained from the city's contracted waste-hauler, Waste Management, Inc. The agency released records indicating the total amount of waste the agency collected as result of the City of Hughson's government operations in 2005. The records indicated the amount of waste collected by volume (cubic yards). The records also indicated that, on average, 100% of waste was sent to landfill. Data was inputted into CACP 2009, and then calculated based on pre-set emission factors to determine an emissions estimate for this sector.

Collecting the data from this sector proved to be difficult overall. This may be due in part to the fact that private companies were relied upon to provide the activity data required. However, private companies may not be required to retain operational records, as government agencies are required. It is recommended that since private companies are not often required to maintain records for long periods of time, the city maintain its own internal records of waste sent to landfill by waste type and department/division.

## Employee Commute

While the emissions that employees generate from burning fossil fuels in their vehicle on their commute to and from work are not controlled by the City of Hughson, the city has the opportunity to recommend best practices (e.g. carpooling, public transit) to its employees. Because these emissions are not a direct result of government operations, they are deemed Scope 3. There are two types of activity data to be collected in an inventory of employee commute-related emissions: the quantity and type of fuel consumed, which primarily determines the magnitude of $CO_2$ emissions; and vehicle miles travelled (VMT), which determines the magnitude of $CH_4$ and $N_2O$ emissions at varying rates

depending on the vehicle and fuel type. While the LGO Protocol does not provide specific recommendations for estimating emissions from the employee commute sector, ICLEI has provided a reliable process for assessing emissions from this sector via survey and extrapolation, using methodologies similar to those used in the vehicle fleet sector.

Survey responses were collected from a sample of current employees representing the total population of employees in the year 2005. The total population of employees in 2005 was provided by the city, and was used to extrapolate responses from the sample. Overall, 13 responses were collected resulting in a sample of approximately 65% of employees at 2005 staff-levels (20 FTE). The survey responses were compiled on an electronic spreadsheet, which was conducive to calculation. Fuel consumption and VMT data from 2010 were extrapolated to estimate 2005 levels. Therefore, the actual emissions from employee commute in 2005 were not obtained; rather, 2010 data was used as proxy data.

In addition to activity data regarding fuel consumption and VMT, these surveys yielded information regarding a number of commute-related topics. Among these were statistics on employee preferences for alternative means of travel, as well as open-ended comment sections. Some of these topics are highlighted in the Inventory Results section above. The remaining information can be found in MDWB.

# Next Steps

## ICLEI's Five Milestone Process

While City of Hughson has already begun to reduce greenhouse gas emissions through its actions, this inventory represents the first step in a systematic approach to reducing City of Hughson's emissions. This system, developed by ICLEI, is called the Five Milestones for Climate Mitigation. This Five Milestone process involves the following steps:

**Milestone One:** Conduct a baseline emissions inventory and forecast

**Milestone Two:** Adopt an emissions reduction target for the forecast year

**Milestone Three:** Develop a local climate action plan

**Milestone Four:** Implement the climate action plan

**Milestone Five:** Monitor progress and report results

### Figure 11: ICLEI's Five Milestones for Climate Mitigation

ICLEI staff are available to local governments who are members and should be contacted to discuss the full range of resources available at each stage of the Milestone process. The following sections provide a glimpse at next steps and help capture the lessons learned in conducting this inventory.

## Setting Emissions Reduction Targets

This inventory provides an emissions baseline that can be used to inform Milestone Two of ICLEI's Five-Milestone process—setting emissions reduction targets for City of Hughson's municipal operations. The greenhouse gas emissions reduction target is a goal to reduce emissions to a certain percentage below base year levels by a chosen planning horizon year. An example target might be a 30 percent reduction in emissions below 2005 levels by 2020. A target provides an objective toward which to strive and against which to measure progress. It allows a local government to quantify its commitment to fighting global warming—demonstrating that the jurisdiction is serious about its commitment and systematic in its approach.

In selecting a target, it is important to strike a balance between scientific necessity, ambition, and what is realistically achievable. City of Hughson should give itself enough time to implement chosen emissions reduction measures—noting that the farther out the target year is, the more City of Hughson should pledge to reduce. ICLEI recommends that regardless of the chosen long-term emissions reduction target (e.g., 15-year, 40-year), City of Hughson should establish linear interim targets for every two- to three-year period. Near-term targets facilitate additional support and accountability, and linear goals help to ensure continued momentum around local climate protection efforts. To monitor the effectiveness of its programs, City of Hughson should plan to re-inventory its emissions on a regular basis; many jurisdictions are electing to perform annual inventories. ICLEI recommends conducting an emissions inventory every three to five years.

### The Long-Term Goal

ICLEI recommends that near-term climate work should be guided by the long-term goal of reducing its emissions by 80 percent to 95 percent from the 2005 baseline level by the year 2050.[3] By referencing a long-term goal that is in accordance with current scientific understanding, City of Hughson can demonstrate that it intends to do its part towards addressing greenhouse gas emissions from its internal operations.

It is important to keep in mind that it will be next to impossible for local governments to reduce emissions by 80 to 95 percent without the assistance of state and federal policy changes that create new incentives and new sources of funding for emissions reduction projects and programs. However, in the next 15 years, there is much that local governments can do to reduce emissions independently. It is also important that City of Hughson works to reduce its emissions sooner, rather than later: the sooner a stable level of greenhouse gases in the atmosphere is achieved, the less likely it is that

[3] 2050 targets taken from California Executive Order S-3-05 and Intergovernmental Panel on Climate Change (IPCC).

some of the most dire climate change scenarios will be realized. Additionally, cost saving projects can be undertaken now – why wait to increase the quality of local government service and operations, while reducing taxpayer costs?

## State of California Targets and Guidance

An integral component of the State of California's climate protection approach has been the creation of three core emissions reduction targets at the community level. While these targets are specific to the community-scale, they can be used to inform emissions targets for government operations as well. On June 1, 2005, California Governor Schwarzenegger signed Executive Order S-3-05 establishing climate change emission reductions targets for the State of California. The California targets are an example of near-, mid- and long-term targets:

- Reduce emissions to 2000 levels by 2010
- Reduce emissions to 1990 levels by 2020
- Reduce emissions to 80 percent below 1990 levels by 2050

The AB 32 Scoping Plan also provides further guidance on establishing targets for local governments; specifically the Plan suggests creating an emissions reduction goal of 15 percent below "current" levels by 2020. This target has informed many local government's emission reduction targets for municipal operations—most local governments in California with adopted targets have targets of 15 to 25 percent reductions under 2005 levels by 2020.

## Departmental Targets

If possible, ICLEI recommends that City of Hughson consider department-specific targets for each of the departments that generate emissions within its operations. This allows City of Hughson staff to do a more in-depth analysis of what is achievable in each sector in the near, mid and long-term, and also provides encourages department leaders to consider their department's impact on the climate and institute a climate-conscious culture within their operations.

# Creating an Emissions Reduction Strategy

This inventory identifies the major sources of emissions from City of Hughson's operations and, therefore, where policymakers will need to target emissions reductions activities if they are to make significant progress toward adopted targets. For example, since largest sector was a major source of emissions from City of Hughson's operations, it is possible that City of Hughson could meet near-term targets by implementing a few major actions within the Water Transport and/or the Wastewater sectors. Medium-term targets could be met by focusing emissions reduction actions on the Vehicle Fleet, Buildings and Facilities sectors, for instance, and the long term (2050) target will not be achievable without major reductions in all of these sectors.

Please note that, whenever possible, reduction strategies should include cost-saving projects that both reduce costs (such as energy bills) while reducing greenhouse gas emissions. These "low hanging fruit" are important because they

frequently represent win-win situations in which there is no downside to implementation. Selecting these projects in the order of largest to smallest benefit ensures that solid, predictable returns can be realized locally. These projects lower recurring expenditures, save taxpayer dollars, create local jobs, and benefit the community environmentally.

Given the results of the inventory, ICLEI recommends that City of Hughson focus on the following tasks in order to significantly reduce emissions from its government operations:

- Analyze reduction potential for streetlights and other public lighting
- Change procurement policy to recommend recycled, reusable and recyclable materials, including office supplies (e.g. paper, cardboard, cans, toner cartridges)
- Change procurement policy to specify energy star compliant HVAC systems and refrigerators
- Change procurement policy to specify high fuel efficiency for each vehicle class.
- Comprehensive analysis of waste stream.
- Comprehensive municipal retrofit of existing buildings including lighting, insulation, windows and HVAC systems for improved energy efficiency, cost savings, and building performance
- Develop an equipment database to help with the reuse of old furniture and fixtures
- Encourage and incentivize employees to use alternative modes of transportation by offering enhanced commuter benefits. Explore various policies to encourage walking and biking in good weather by employees that live within 5 miles, and to encourage carpooling by all employees.
- Encourage and incentivize telecommuting to reduce emissions from employee commute
- Exploration of biofuels to replace vehicle fleet fuel usage
- Explore implementing a no-idling policy for fleet vehicles
- Implement paper and toner reduction strategies to reduce excess paper and toner usage, e.g. double-sided printing and fonts that use less ink (i.e., Century Gothic, Times New Roman and Calibri)
- Install smart lighting fixtures with occupancy sensors
- Procure solar or other low-carbon based electricity.
- Promote procurement of plug-in hybrids where practical, which can reduce vehicle emissions by up to 50%.
- Promote training, education, rewards, incentives, encouragement and support for emissions reductions across the board.
- Review feasibility of alternative energy production at city facilities
- Switch to refrigerants that have a lower GWP (global warming potential)
- Switch traffic signals from incandescent bulbs to Light Emitting Diodes (LEDs)

- Participate in Phase II of Green Communities: Community-Wide Inventories, in order to gather necessary data to develop effective policies which result in extensive reductions through implementation of a Climate Action Plan for the larger community.

Using these strategies as a basis for a more detailed overall emissions reductions strategy, or climate action plan, City of Hughson should be able to reduce its impact on global warming. In the process, it may also be able to improve the quality of its services, reduce costs, stimulate local economic development, and inspire local residents and businesses to redouble their own efforts to combat climate change.

## Improving Emissions Estimates[4]

One of the benefits of a local government operations emissions inventory is that local government staff can identify areas in their current data collection systems where data collection can be improved. For example, a local government may not directly track fuel consumption by each vehicle and instead will rely upon estimates based upon VMT or purchased fuel to calculate emissions. This affects the accuracy of the emissions estimate and may have other implications for government operations as a whole.

During the inventory process, City of Hughson staff identified the following gaps in data that, if resolved, would allow City of Hughson to meet the recommended methods outlined in LGO Protocol in future inventories.

- An improved method of tracking the amount of waste generated by division, department or facility. During the inventory, attempts were made to obtain government-generated solid waste data from the city's contracted waste-haulers. However, private sector companies do not often maintain records as far back as five years. It is recommended that the city record this data internally for future inventory use.
- An improved method of tracking fuel consumption by individual vehicles
- An improved method of tracking vehicle miles travelled (VMT) by individual vehicles, such as recording odometer readings periodically during re-fueling
- Ask the city's air conditioning and refrigeration maintenance division to determine exact original charge of refrigerants into building air conditioning/refrigeration systems at the beginning of each year. In addition, it is recommended that the city track the amount of refrigerants recharged into air conditioning and refrigeration equipment, as well as the amount recycled, disposed of, and returned to the supplier.
- Ask the city's waste contractors to conduct waste stream assessments
- Differentiate between routine vehicle fuel purchases and the purchase of fuels for canteens and re-fueling vehicles, and track actual consumption by vehicle/equipment.

[4] Accepting this Narrative Report and the corresponding GHG Emissions Inventory does not necessarily mean a commitment to implement these data collection recommendations. Rather, these recommendations serve as indicators of gaps in data collection as well as guidelines for filling those gaps.

- Direct tracking of fire suppressants recharged into fire suppression equipment by amount and type
- Direct tracking of street light conversion to LED
- Track electricity consumption by streetlights that are currently not metered by Turlock Irrigation District
- Track employee business travel reimbursements and require vehicle detail (e.g. make, model, year, fuel economy) to be noted on the forms
- Track employee business travel reimbursements and require vehicle detail (e.g. make, model, year, fuel economy) to be noted, along with mileage, on reimbursement forms
- Track fuel consumption by backup generators and by fuel type
- Track fuel consumption by specific equipment and off-road vehicles, separate from vehicle fleet
- Track the amount and type of refrigerants recharged into vehicles in the vehicle fleet
- Track utility invoices by department and reconcile with total utility costs
- Track utility use billed to each department and division
- When vehicles are acquired, record odometer reading, refrigerant level, and exact date of acquisition
- When vehicles are retired from the fleet, record odometer reading, refrigerant level, and exact date of retirement

ICLEI encourages staff to review the areas of missing data and establish data collection systems for this data as part of normal operations. In this way, when staff are ready to re-inventory for a future year, they will have the proper data to make a more accurate emissions estimate.

## Project Resources

ICLEI has created tools for City of Hughson to use to assist with future monitoring inventories. These tools are designed to work in conjunction with LGO Protocol, which is the primary reference document for conducting an emissions inventory. The following tools should be saved as resources and supplemental information to this report:

- The "Master Data Workbook" that contains most or all of the raw data (including emails), data sources, emissions, notes on inclusions and exclusions, and reporting tools
- The "Data Gathering Instructions" on the types of emissions and data collection methodology for each inventory sector.
- The "Quality Control Checklist for Master Data Workbook" which provides a list of items to review in the Master Data Workbook to ensure information was entered correctly.
- The "CACP 2009 Data Entry Instructions" which provides guidance on how to enter data collected in the Master Data Workbook into CACP 2009 to calculate greenhouse gas emissions.

- Clean Air & Climate Protection Software (CACP) "Backup" file which contains the calculations of emissions based on inputs from the Master Data Workbook. CACP software is required to open the Backup file.
- The "Checklist for Reviewing the Government Analysis Inputs/Outputs, Details Export" which provides a list of items to review in this CACP export file to ensure information was entered correctly.
- CACP "Government Analysis Inputs/Outputs, Summary with Notes Export Report", which contains a summary report in Excel format of all calculated emissions, with explanatory notes included.
- CACP "Government Analysis Inputs/Outputs, Details Export Report", which contains a detailed report in Excel format of all calculated emissions.
- The "Completing the Inventory Report" instructions from ICLEI for LGO greenhouse gas inventories.
- The "Charts and Tables Data Conditioning Sheet" created by ICLEI and completed by the author to aid in creating the charts and tables within the MDWB.
- A presentation with slides was also completed by the author to summarize project findings.

HUGHSON
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# Appendix A

## A. 2005 General Plan

1) Policy LU-4.4: The City will encourage the development of mixed use developments along Hughson Avenue, with residential and commercial uses in the same building.
2) Policy LU-5.7: Neighborhoods should be physically connected to one another via a series of roadways and pedestrian paths, and all residents should be within a short walk or drive of retail and other services.
3) Policy C-1.1: Hughson will develop a connected street pattern with multiple route options for vehicles, bicycles and pedestrians.
4) Policy C-1.6: Local street width shall be limited to the minimum necessary to adequately carry the amount of anticipated traffic and allow for adequate bicycle and pedestrian facilities and emergency access.
5) Policy C-1.11: To create a walkable community that provides pedestrian and bicycle connections, dead-end cul-de-sacs lacking pedestrian and/or bicycle access to adjoining streets or public areas will be discouraged.
6) Policy C-3.1: The City will promote pedestrian activity as one of the primary modes of travel in the Downtown.
7) Policy C-3.2: Circulation system improvements in the Downtown should reduce traffic speeds in order to preserve and enhance the pedestrian friendliness of the Downtown, while allowing for adequate vehicular access to local businesses.
8) Policy C-3.3: Implement the roadway improvements identified in the façade and downtown improvement project to improve the pedestrian friendly environment of the Downtown.
9) Policy C-5.1: The City will continue to support the activities of Stanislaus Regional Transit.
10) Policy C-5.2 Stanislaus Regional Transit will be encouraged to explore the possibility of expanding the transit system to provide additional service between Hughson and major regional employment and commercial areas.
11) Policy C-5.3: The City will support ride-share lots and car-pooling, as well as other initiatives aimed at reducing the number of single occupancy vehicles commuting out of Hughson.
12) Policy C-5.4: Work with employers to encourage ridesharing (carpools and vanpools), public transit, bicycling, walking, flexible working hours and preferential parking.

13) Policy C-6.1: Safe, attractive and convenient bicycle and pedestrian facilities will be provided to link schools, parks, civic facilities, employment centers, shopping and Downtown, as well as provide a viable alternative to the automobile.

14) Policy C-6.2: The City will explore ways to connect local bicycle and pedestrian routes to larger regional systems, including those established in the Regional Bicycle Action Plan, adopted in 2001 by the StanCOG to implement the Regional Bicycle Transportation Master Plan of 1996.

15) Policy C-6.3: The City will work with the Burlington Northern/Santa Fe Railroad to improve railroad crossings to address pedestrian and bicyclist safety. Alternatives such as over and underpasses at major crossings will be explored.

16) Policy C-6.4: New development will be required to provide sidewalks and connections to the community-wide bicycle and pedestrian network.

17) Policy C-6.6: New bicycle and pedestrian facilities will be designed to incorporated visual features that define the routes and encourage their use, such as trees, signage, special paving materials and attractive light fixtures.

18) Policy COS-5.2: The City will encourage the use of water conservation technology to reduce water consumption by irrigation, domestic and industrial uses.

19) Policy COS-5.3: The City will encourage the use of solar energy design, including passive systems, active water heating and space heating systems in all civic buildings.

20) Action COS-5.1: Explore the creation of incentives for development that will encourage the incorporation of energy conservation features into project design, such as photovoltaic cells, and promote the use of alternative-fuel vehicles. Incentives that may be explored include flexibility in design and regulations and financial assistance.

21) Action COS 5.2: Consider providing information to residents and developers about "green building" and sustainable site design principles and practices applicable to both new construction and renovations.

22) Policy COS 7.1: The City will support the efforts of the San Joaquin Valley Air Pollution Control District (SJVAPCD) and other regional air quality management planning, programs, educational and enforcement measures.

23) Policy COS 7.2: New development proposals will be reviewed, and industrial activities monitored, for compliance with State and regional air quality standards. Mitigation measures will be required if needed.

24) Policy COS 7.3: Project-level environmental review, using the SJVAPCD analysis methods and significance thresholds, will be required to include impacts to air quality and consider alternatives that reduce emissions of air pollutants.

25) Policy COS 7.4: New development projects will adopt and implement a construction-period air pollution control plan, consistent with SJVAPCD guidelines, as well as incorporate construction emissions control measures recommended by the SJVAPCD.

26) Policy COS 7.8: The City will encourage compact development patterns to minimize trip distance and resultant automobile emissions.

27) Policy COS 7.10: Land use and transportation development and planning shall be coordinated with each other as a means to mitigate impacts on air quality.

28) Policy COS 7.11: Developers will be referred to the SJVAPCD to discuss entering into an Air Quality Mitigation Agreement directly with the District to help reduce and mitigate emissions generated from future developments.

29) Action COS 7.3: Consider implementing an air quality impact fee program as recommended by SJVAPCD to provide for partial mitigation of adverse environmental effects and establish a formalized process to assess air quality impacts of new development.

30) Action PSF 6.2: Develop and institute a City-sponsored program of mandatory water conservation measures for new development.

31) Action PSF 7.2: Investigate the potential for and implement, as appropriate, innovative recycled water use systems in Hughson, as well as identify sources of funding for implementation of the recycled water system.

32) Policy PSF 9.2: The City will seek to meet or exceed State requirements with regard to waste diversion, recycling and composting.

33) Policy PSF 9.3: Encourage Hughson's residents, businesses and industries to pursue waste reduction at the source, including packaging.

## B. Hughson Municipal Code, Title 17 – Zoning Ordinance

1) 17.02.012. Commercial Zones.

B. Allowed uses. The uses allowed in commercial districts shall be as provided in Table 17.02.032.1.

1. Exceptions.

a. Car washes are only allowed with recycled water systems.

b. Drive through windows for restaurants are prohibited.

2) 17.03.012 Alternate energy sources.

A. Purpose. The purpose of this section is to encourage and promote the use of alternate energy sources by providing solar and wind access protection.

B. Solar energy collection systems. A solar energy collection system must be issued a nondiscretionary building permit if it complies with the requirements of 1 through 4 below.

1. When a solar energy collection system is installed on a lot, any accessory structure or vegetation on an abutting lot shall not be located so as to block the solar collector's access to solar energy. The portion of the solar collector that is protected is that portion which:

a. Is located so as not to be shaded between the hours of 10:00 a.m. and 3:00 p.m. by a hypothetical 12-foot obstruction located on the lot line; and

b. Has an area of not greater than one-half of the heated floor area of the structure, or the largest of the structures served.

2. This subsection does not apply to accessory structures or vegetation existing on an abutting lot at the time of installation of the solar energy collection system, or on the effective date of the ordinance codified in this section, whichever is later. This section controls any accessory structure erected on, or vegetation planted on, abutting lots after the installation of the solar energy collection system.

3. A copy of the building permit for the solar energy collection system shall be kept on file with the building division. The solar facility must be completed and have a final inspection, approved by the building inspector, within one calendar year from the date the building permit is issued.

4. A solar energy system for heating water shall be certified by the Solar Rating Certification Corporation (SRCC) or other nationally recognized agency.

C. Clotheslines. It shall be unlawful to establish any private covenant or restriction which prohibits the installation and/or use of a clothesline in any residential zone;

D. Wind Energy Conversion Systems (WECS). Wind energy conversion systems shall be permitted in all zones subject to the following requirements:

1. Building Permit application for a WECS. A WECS will require approval of a building permit, as regulated in Hughson Municipal Code Title 15. In addition to standard submittal requirements for building permits, applications for a wind energy conversion system shall be accompanied by a plot plan drawn in sufficient detail to clearly describe the following:

a. Property line and physical dimensions of the site;

b. Locations, dimensions, and types of existing structures and uses on-site;

c. Location of the proposed WECS;

d. Location of all aboveground utility lines on-site or within one radius of the total height of the WECS;

e. Location and size of the largest structure taller than 35 feet or tree which may potentially grow taller than 35 feet during the lifetime of the WECS within a 500-foot radius of the proposed WECS; and

f. All information necessary to show compliance with the California Building Code.

3) 17.03.048 Landscaping.

A. Purpose. The purpose of this section is to establish the necessary criteria, standards and limits for landscaping and to maximize the value of this land use along public rights-of-way and within specified portions of private property. The provisions of this section are intended to accomplish the following:

5. To reduce air, noise and visual pollution; and

6. To promote water conservation by use of appropriate plants and conservative irrigation systems.

E. Requirements for all landscaping.

3. Irrigation. Irrigation for all landscaping subject to this section shall meet the following requirements:

a. To the extent possible, drought resistant plant material shall be used.

b. All landscaped areas shall be served by a permanent irrigation system, such as an automatic sprinkler or drip irrigation system. The irrigation system shall include timers and rain shutoff devices to prevent excessive and unnecessary watering.

c. The Planning Officer may waive this subsection's irrigation requirements for specified landscape areas upon finding the following:

i. The landscaping in the specified areas is composed of drought-tolerant vegetation or other plant materials that do not require permanent irrigation to remain in healthy condition.

ii. The specified areas will receive adequate temporary irrigation to allow the plants to become established.

iii. There are no considerations of public health, safety or welfare, including aesthetic considerations, that require installation of a permanent irrigation system.

4) 17.03.056 Outdoor lighting.

A. Purpose. To minimize the impact of outdoor lighting on adjacent properties, as well and minimize energy use, all outdoor lighting on private property shall conform to the following requirements.

C. Energy-saving. Lighting shall be provided with energy-saving fixtures and lamps to the extent practicable.

5) 17.03.060 Parking.

A. Purpose. The purpose of this section is to provide accessible off-street parking facilities for the parking of self-propelled motor vehicles and bicycles on public or private property in connection with the erection or major alteration, extension or change of use of any building or structure, unless otherwise stipulated, in the amounts as specified in this section.

I. Bicycle parking.

1. All non-residential uses and multiple family residential uses shall provide at least two bicycle parking spaces, or one bicycle parking space for every 20 required motor vehicle parking spaces, whichever is greater.

2. In addition to any requirements in the City Construction Specifications, each bicycle parking space shall provide a securely-anchored, stationary parking device that is adequate to lock and secure a six foot long bicycle.

3. All bicycle parking spaces shall be conveniently located to the buildings that they serve, and pedestrian walkways shall be provided between the bicycle parking spaces and the nearest building entrance.

4. For multi-family residential uses that are required to provide bicycle parking, all required bicycle parking spaces shall be located in permanently covered areas, either inside or outdoors, that are designed to protect the bicycle from rainfall.

6) 17.03.092 Trees.

A. Purpose. The City of Hughson recognizes the historical, environmental and aesthetic importance of its tree population and orchards. The City Council finds that Hughson's rural attractiveness and visual character is closely tied to the City's established larger trees, street trees and orchards; that these trees provide shade and cooling during Hughson's hot summers; and that the preservation of such trees is necessary to prevent erosion of topsoil, protect against flood hazards, counteract pollutants in the air, and decrease wind velocities.

## C. Conservation and Open Space Element Amendment, General Plan (2010)

5) Energy Conservation

| | |
|---|---|
| **Goal COS-1** | **Minimize the consumption of energy, water and non-renewable resources.** |

Policy COS-1.1 New development shall comply with State Title 24 energy resource conservation standards.

Policy COS-1.2 The City will encourage the use of water conservation technology to reduce water consumption by irrigation, domestic and industrial uses.

Policy COS-1.3 The City will encourage the use of solar energy design, including passive systems, active water heating and space heating systems in all civic buildings.

Action COS-1.1 Explore the creation of incentives for development that will encourage the incorporation of energy conservation features into project design, such as photovoltaic cells, and promote the use of alternative-fuel vehicles. Incentives that may be explored include flexibility in design and regulations and financial assistance.

Consider providing information to residents and developers about "green building" and sustainable site design principles and practices applicable to both new construction

7) Air Quality

| | |
|---|---|
| **Goal COS-2** | **Protect and improve air quality in the Hughson area.** |

Policy COS-2.1 The City will support the efforts of the San Joaquin Valley Air Pollution Control District (SJVAPCD) and other regional air quality management planning, programs, educational and enforcement measures.

Policy COS-2.2 New development proposals will be reviewed, and industrial activities monitored, for compliance with State and regional air quality standards. Mitigation measures will be required if needed.

Policy COS-2.3 Project-level environmental review, using the SJVAPCD analysis methods and significance thresholds, will be required to include impacts to air quality and consider alternatives that reduce emissions of air pollutants.

Policy COS-2.4 New development projects will adopt and implement a construction-period air pollution control plan, consistent with SJVAPCD guidelines, as well as incorporate construction emissions control measures recommended by the SJVAPCD.

Policy COS-2.5 Dust control measures consistent with San Joaquin Valley Air Pollution Control District rules shall be required as a condition of approval for subdivision maps, site plans, and all grading permits.

Policy COS-2.6 New sources of toxic air pollutants shall prepare a Health Risk Assessment as required under the Air Toxics "Hot Spots" Act and, based on the results of the Assessment, establish appropriate land use buffer zones around those areas posing substantial health risks.

Policy COS-2.7 Sensitive air quality receptors, such as residential uses, schools and hospitals, and industries that generate toxic emissions should not be located in proximity to one another.

Policy COS-2.8 The City will encourage compact development patterns to minimize trip distance and resultant automobile emissions.

Policy COS-2.9 EPA-certified wood stoves, fireplaces, pellet stoves and natural gas fireplaces shall be required in renovations, while new residential development will only be allowed to install gas burning fireplaces consistent with SJVAPCD regulations.

Policy COS-2.10 Land use and transportation development and planning shall be coordinated with each other as a means to mitigate impacts on air quality.

Policy COS-2.11 Developers will be referred to the SJVAPCD to discuss entering into an Air Quality Mitigation Agreement directly with the District to help reduce and mitigate emissions generated from future developments.

Action COS-2.2 Conduct a study to identify current air pollution sources within the City that could be minimized or controlled and develop programs and partnerships for mitigation.

Action COS-2.3 Implement the County's air quality improvement program with regards to the management of fugitive dust.

Action COS-2.4 Consider implementing an air quality impact fee program as recommended by SJVAPCD to provide for partial mitigation of adverse environmental effects and establish a formalized process to assess air quality impacts of new development.

# APPENDIX C: HUGHSON GHG REDUCTION STRATEGIES

# City of Hughson Energy Strategies
# Summary Table

| | | CO2 (MT) | | |
|---|---|---|---|---|
| **ID** | **Strategy Name** | **GHG Reduction in 2020** | **GHG Reduction in 2030** | **Annual Cost to the City (low, medium, or high)** |
| **Goal E.1: Increase Building and Equipment Efficiency Community-Wide** | | | | |
| Strategy E.1.1 | Residential Green Building Standards | 446 | 762 | Low |
| Strategy E.1.2 | Residential Energy Efficiency Promotion | 128 | 257 | Low |
| Strategy E.1.3 | Commercial Energy Efficiency Promotion | 543 | 768 | Low |
| Strategy E.1.4 | Use of Smart Meters | 11 | 14 | Low |
| Strategy E.1.5 | Industrial Equipment Energy Efficiency Promotion | 100 | 140 | Low |
| Strategy E.1.6 | Shade Trees | 242 | 280 | Low |
| **Goal E.2: Increase Renewable Energy Generation and Use Community-Wide** | | | | |
| Strategy E.2.1 | On-Site Renewable Energy for Homes | 307 | 721 | Low |
| Strategy E.2.2 | On-Site Renewable Energy for Commercial and Industrial Users | 23 | 83 | Low |
| Strategy E.2.3 | Regional Renewable Energy Partnerships | N/A | N/A | Low |
| **Improve Municipal Operations Energy Efficiency and Renewable Energy Generation** | | | | |
| Strategy E.3.1 | Increase Municipal Energy Efficiency | 12 | 28 | Low |
| Strategy E.3.2 | Increase Municipal Renewable Energy | - | - | Low |
| | **Totals:** | **1,813** | **3,053** | |

# Energy: Common Factors

Factors with a pale yellow background color are not subject to change for Hughson. Factors with a pale green background color are subject to modification, based on the implementation depth of the particular reduction strategy.

| | # | Unit |
|---|---|---|
| **Basic Unit Factors** | | |
| Hours in a year | 8,760 | |
| Hours of daylight in a year | 2,920 | |
| Pounds per Metric Ton | 2,204.6 | |
| Kwh per Mwh | 1,000 | |
| lbs of CO2 emissions from 1 therm of natural gas | 11.70 | |
| **GHG Emission Factors** | | |
| TID Electricity emission factor (lbs/kWh) | 0.6820 | lbs $CO_2$/kWh |
| TID Emission Factor (MT/MWh) | 0.3094 | MT $CO_2$/MWh |
| TID Electricity emission factor (lbs/MWh) | 0.0290 | lbs $CH_4$/MWh |
| TID Electricity emission factor (lbs/MWh) | 0.0110 | lbs $N_2O$/MWh |
| Natural Gas emission factor (kg/MMBtu) | 53.0200 | kg CO2/MMBtu |
| Natural Gas emission factor (kg/MMBtu) | 0.0050 | kg CH4/MMBTU |
| Natural Gas emission factor (kg/MMBtu) | 0.0001 | kg N2O/MMBTu |
| **Projected City Growth Factors** | | |
| Average Square Feet Per Residential Unit (Existing Housing Stock) | 1,448 | square ft |
| Average Square Feet Per Residential Unit (New Housing Stock) | 2,061 | square ft |
| 2005 Residential Square Feet | 2,772,920 | square ft |
| 2020 Residential Square Feet | 4,081,655 | square ft |
| 2030 Residential Square Feet | 5,009,105 | square ft |
| 2005 Non-Residential Square Feet | 640,500 | square ft |
| 2020 Non-Residential Square Feet | 640,500 | square ft |
| 2030 Non-Residential Square Feet | 769,626 | square ft |
| Total square feet of new construction residential space from 2005 to 2020 | 1,308,735 | square ft |
| Total square feet of new construction residential space from 2005 to 2030 | 2,236,185 | square ft |
| Total sq. feet of new construction commercial space from 2005 to 2020 | 64,050 | square ft |

| | | |
|---|---|---|
| Total sq. feet of new construction commercial space from 2005 to 2030 | 129,126 | square ft |
| Total # of housing units in the City in 2005 | 1,915 | Housing Units |
| Total # of housing units in the City in 2020 | 2,550 | Housing Units |
| Total # of housing units in the City in 2030 | 3,000 | Housing Units |
| Total # of commerical units in the City in 2005 | 242 | units |
| Total # of commercial units in 2020 | 242 | units |
| Total # of commercial units in 2030 | 291 | units |
| City Square Mileage | 1.82 | sq. mile |
| City Sphere-of-Influence (SOI) Square Mileage | 1.9 | sq. mile |
| City of Hughson Acres in 2005 | 1,162 | Acres |
| City of Hughson Acres in 2020 | 1,162 | Acres |
| City of Hughson Acres in 2030 | 2,378 | Acres |
| Housing Units per Acre in 2005 | 1.65 | units per acre |
| Housing Units per Acre in 2020 | 2.20 | units per acre |
| Housing Units per Acre in 2030 | 1.26 | units per acre |

| **California State Energy Intensity Factors** | | |
|---|---|---|
| Avg. electric use intensity for res. buildings in kWh/sq ft. - California | 3.50 | kwh/square foot |
| Avg. natural gas usage intensity for res. buildings in therms/sqft - California | 0.31 | therms/square feet |
| Avg. electric use intensity for comm. buildings in kWh/sq ft. - California | 13.63 | kwh/square foot |
| Avg. natural gas usage intensity for comm. buildings in therms/sq ft - California | 0.26 | therms/square feet |

| **City of Hughson (Derived) Energy Intensity Factors** | | |
|---|---|---|
| City electric use intensity factor for res. buildings in kWh/sq ft. | 2.57 | kwh/square foot |
| City natural gas intensity factor for res. buildings in therms/sq ft. | 0.30 | therms/square feet |
| City electric use intensity factor for comm. buildings in kWh/sq ft. | 2.65 | kwh/square foot |
| City natural gas use intensity factor for comm. buildings in therms/sq ft. | 1.83 | therms/square feet |

| **Cost Factors** | | |
|---|---|---|
| BLS U.S. Department of Labor: Average Stanislaus County Salary | $ 40,768.00 | Salary |
| BLS U.S. Department of Labor: Average Stanislaus County Hourly Rate | $ 20.22 | Hourly Rate |

| **Other** | | |
|---|---|---|
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | |

# Strategy GHG and Cost Analysis Worksheet: E 1.1

| | |
|---|---|
| **Strategy Name** | Residential Green Building Standards |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Forecasted total square feet of new residential construction from 2005 to 2020 | 1,308,735 | square ft | NCa |
| Forecasted total square feet of new residential construction from 2005 to 2030 | 2,236,185 | square ft | NCb |
| % nat gas savings from minimum compliance of 2013 Title 24 update already accounted for in Adjusted BAU | 0.0% | percent | Sa |
| % electricity savings from minimum compliance of 2013 Title 24 update already accounted for in Adjusted BAU | 0.0% | percent | Sb |
| Additional reduction in electricity and nat. gas usage for new buildings meeting 2013 Title 24 Tier 1 (15% above minimum requirement). | 15.0% | percent | R |
| Residential development during the 2005-2020 timeframe expected to be compliant with Title 24 Tier 1 (2013 update, effective 1/1/2014). | 100.0% | percent | $P_{2020}$ |
| Residential development during the 2005-2030 timeframe expected to be compliant with Title 24 Tier 1 (2013 update, effective 1/1/2014). | 100.0% | percent | $P_{2030}$ |
| 2005 baseline Hughson electric use intensity factor for res. buildings in kWh/sq ft. | 2.57 | kwh/square foot | E |
| 2005 baseline Hughson natural gas intensity factor for res. buildings in therms/sq ft. | 0.30 | therms/square feet | N |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Natural Gas emission factor (kg CO2/MMBtu) | 53.02 | kg CO2/MMBtu | Efb |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| CALGreen Guidance: www.hcd.ca.gov/CALGreen.html - Residential: the 2013 Standards will use 25% less energy for lighting, heating, cooling, ventilation, and water heating than the 2008 Standards. |
| Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11- |
| Projection of GHG Emissions for California Utilities: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/GHG_Emission_Factor_Guidance.pdf |
| Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml |
| State of Indiana. Green Building cost estimates. https://bloomington.in.gov/green-building-costs |

**1. Resource Savings:**

**New Residential Green Building Development:**

Total Electricity Savings by 2020 (kWh) = Nca × (Sb + R) x $P_{2020}$ x E x F

Total Natural Gas Savings by 2020 (therms)= Nca × (Sa + R) x $P_{2020}$ x N

Total Electricity Savings by 2030 (kWh) = Ncb × (Sb + R) x $P_{2030}$ x E x F

Total Natural Gas Savings by 2030: (therms) = Ncb × (Sa + R) x $P_{2030}$ x N

| | | |
|---|---|---|
| Total electricity savings by 2020= | 443,785 | kwh |
| Total natural gas savings by 2020= | 58,220 | therms |
| Total electricity savings by 2030= | 758,278 | kwh |
| Total natural gas savings by 2030= | 99,479 | therms |

**2. GHG Calculations:**

Total Emissions Savings (MT)= (Se/1000×Efa)+(Sg/10 × Efb/1000)

| | |
|---|---|
| Se = | total electricity savings (kWh) |
| Sg= | total natural gas savings (therms) |
| 1000 | = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) |
| 10 | = conversion factor for therm to MMBtu |

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 446 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 762 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E 1.2

| | |
|---|---|
| **Strategy Name** | Residential Energy Efficiency Promotion |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Existing Residential Square Feet Upgraded by 2020 | 277,292 | square ft. | $Rsf_{2020}$ |
| Existing Residential Square Feet Upgraded by 2030 | 554,584 | square ft. | $Rsf_{2030}$ |
| Target Percentage of Electricity Savings[1] | 10.0% | % | E |
| Target Percentage of Natural Gas Energy Savings[1] | 25.0% | % | N |
| Hughson electric use intensity factor for res. buildings in kWh/sq ft. | 2.57 | kwh/square foot | Re |
| Hughson natural gas intensity factor for res. buildings in therms/sq ft. | 0.30 | therms/square feet | Rn |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Natural Gas emission factor (kg CO2/MMBtu) | 53.02 | kg CO2/MMBtu | Efb |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

[1]Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| 2005 California End Use Survey http://www.energy.ca.gov/ceus/ |
| RASS - California Statewide Residential Appliance Saturation Survey http://websafe.kemainc.com/RASS2009/Default.aspx |
| Natural Resource Defense Council. Propery Assessed Clean Energy Programs White Paper: http://pacenow.org/documents/PACE%20White%20Paper%20May%203%20update.pdf |

**1. Resource Savings:**

**Promote Residential Energy Efficiency:**

Residential Electricity Energy Savings (kWh)=E × $Rsf_{2020}$ × Re x F

Residential Natural Gas Savings (therms)=N × $Rsf_{2020}$ × Rn

Residential Electricity Energy Savings (kWh)=E × $Rsf_{2030}$ × Re x F

Residential Natural Gas Savings (therms)=N × $Rsf_{2030}$ × Rn

| | | |
|---|---|---|
| Total residential electricity savings by 2020= | 62,685 | kwh/year |
| Total residential natural gas savings by 2020= | 20,559 | therms/year |
| Total residential electricity savings by 2030= | 125,371 | kwh/year |
| Total residential natural gas savings by 2030= | 41,119 | therms /year |

**2. GHG Calculations:**

Total Emissions Savings (MT)= (Se/1000×Efa)+(Sg/10 × Efb/1000)

Se = total electricity savings (kWh)

Sg= total natural gas savings (therms)

1000 = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)

10 = conversion factor for therm to MMBtu

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 128 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 257 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E.1.3

| | |
|---|---|
| **Strategy Name** | Commercial Energy Efficiency Promotion |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Existing Commercial Square Feet Upgraded by 2020[1] | 192,150 | square ft. | $Csf_{2020}$ |
| Existing Commercial Square Feet Upgraded by 2030[2] | 256,200 | square ft. | $Csf_{2030}$ |
| Post-2005 Commercial Square Feet Upgraded by 2020 | 64,050 | square ft. | $Csg_{2020}$ |
| Post-2005 Commercial Square Feet Upgraded by 2030 | 129,126 | square ft. | $Csg_{2030}$ |
| Target Percentage of Electricity Savings for Existing Businesses[3] | 10.0% | % | E |
| Target Percentage of Natural Gas Energy Savings for Existing Businesses[3] | 25.0% | % | N |
| Target Percentage of Electricity Savings for Post-2005 Businesses[3] | 5.0% | % | G |
| Target Percentage of Natural Gas Energy Savings for Post-2005 Businesses[3] | 10.0% | % | M |
| Hughson electric use intensity factor for comm. buildings in kWh/sq ft. | 2.65 | kwh/square foot | Ce |
| Hughson natural gas use intensity factor for comm. buildings in therms/sq ft. | 1.83 | therms/square | Cn |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Natural Gas emission factor (kg CO2/MMBtu) | 53.02 | kg CO2/MMBtu | Efb |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

[1]Assumed 65% of 2005 non-residential square footage by 2020

[2]Assumed 70% of 2005 non-residential square footage by 2030

[3]Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| 2005 California End Use Survey http://www.energy.ca.gov/ceus/ |
| RASS - California Statewide Residential Appliance Saturation Survey http://websafe.kemainc.com/RASS2009/Default.aspx |
| Natural Resource Defense Council. Propery Assessed Clean Energy Programs White Paper: http://pacenow.org/documents/PACE%20White%20Paper%20May%203%20update.pdf |

**1. Resource Savings:**

| **Promote Residential Energy Efficiency:** | | |
|---|---|---|
| Commercial Electricity Energy Savings (kWh)=(E × Csf × Ce)+(G x Csg x Ce) x F<br>Commercial Natural Gas Savings (therms)= (N × Csf × Cn)+(M x Csg x Cn) x F | | |
| Total commercial electricity savings by 2020= | 52,277 | kwh/year |
| Total commercial natural gas savings by 2020= | 99,405 | therms /year |
| Total commercial electricity savings by 2030= | 74,801 | kwh/year |
| Total commercial natural gas savings by 2030= | 140,524 | therms /year |

**2. GHG Calculations:**

| | | |
|---|---|---|
| Total Emissions Savings (MT)= (Se/1000×Efa)+(Sg/10 × Efb/1000) | | |
| Se = total electricity savings (kWh) | | |
| Sg= total natural gas savings (therms) | | |
| 1000 = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) | | |
| 10 = conversion factor for therm to MMBtu | | |
| Total GHG Emissions Savings by 2020= | 543 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 768 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E.1.4

| | |
|---|---|
| **Strategy Name** | Use of Smart Meters |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Commercial Square Feet Upgraded by 2020[1] | 544,425 | square ft. | $Csf_{2020}$ |
| Commercial Square Feet Upgraded by 2030[2] | 654,182 | square ft. | $Csf_{2030}$ |
| Residential Square Feet Upgraded by 2020[3] | 2,040,828 | square ft. | $Rsf_{2020}$ |
| Residential Square Feet Upgraded by 2030[4] | 3,756,829 | square ft. | $Rsf_{2030}$ |
| Target Percentage of Electricity Savings for Commercial Property | 3% | % | E |
| Target Percentage of Electricity Savings for Homes | 3% | % | N |
| Hughson electric use intensity factor for res. buildings in kWh/sq ft. | 2.57 | kwh/square foot | Ce |
| Hughson electric use intensity factor for comm. buildings in kWh/sq ft. | 2.65 | kwh/square foot | Re |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

[1]Assumed 85% of 2005 non-residential square footage by 2030, based on correspondance with Keith Skelly of TID (on March 12, 2013)

[2]Assumed 85% of 2005 non-residential square footage by 2030, based on correspondance with Keith Skelly of TID (on March 12, 2013)

[3]Assumed 85% of 2005 residential square footage by 2020, based on correspondance with Keith Skelly of TID (on March 12, 2013)

[4]Assumed 85% of 2005 residential square footage by 2020, based on correspondance with Keith Skelly of TID (on March 12, 2013)

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| 2005 California End Use Survey http://www.energy.ca.gov/ceus/ |
| RASS - California Statewide Residential Appliance Saturation Survey http://websafe.kemainc.com/RASS2009/Default.aspx |

**1. Resource Savings:**

**Smart Meter Rollout:**

Commercial Electricity Energy Savings (kWh)=E × $Csf_{2020}$ × Ce x F

Commercial Natural Gas Savings (therms)=N × $Csf_{2020}$ × Cn x F

Commercial Electricity Energy Savings (kWh)=E × $Csf_{2030}$ × Ce x F

Commercial Natural Gas Savings (therms)=N × $Csf_{2030}$ × Cn x F

| | | |
|---|---|---|
| Total commercial electricity savings by 2020= | 36,922 | kwh/year |
| Total residential electricity savings by 2020= | 142,774 | kwh/year |
| Total commercial electricity savings by 2030= | 44,366 | kwh/year |
| Total residential electricity savings by 2030= | 262,824 | kwh/year |

**2. GHG Calculations:**

Total Emissions Savings (MT)= (Se/1000×Efa)+(Sg/10 × Efb/1000)

| | |
|---|---|
| Se = | total electricity savings (kWh) |
| Sg= | total natural gas savings (therms) |
| 1000 | = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) |
| 10 | = conversion factor for therm to MMBtu |

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 11 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 14 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E 1.5

| | |
|---|---|
| **Strategy Name** | Industrial Equipment Energy Efficiency Promotion |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Commercial Square Feet Upgraded by 2020[1] | 192,150 | square ft. | $Csf_{2020}$ |
| Commercial Square Feet Upgraded by 2030[2] | 269,369 | square ft. | $Csf_{2030}$ |
| Target Percentage of Electricity Savings | 5% | % | E |
| Target Percentage of Natural Gas Energy Savings | 5% | % | N |
| Hughson electric use intensity factor for comm. buildings in kWh/sq ft. | 2.65 | kwh/square foot | Ce |
| Hughson natural gas use intensity factor for comm. buildings in therms/sq ft. | 1.83 | therms/square | Cn |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Natural Gas emission factor (kg CO2/MMBtu) | 53.02 | kg CO2/MMBtu | Efb |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

[1]Assumed 30% of 2005 non-residential square footage by 2020

[2]Assumed 35% of 2005 non-residential square footage by 2030

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| 2005 California End Use Survey http://www.energy.ca.gov/ceus/ |
| RASS - California Statewide Residential Appliance Saturation Survey http://websafe.kemainc.com/RASS2009/Default.aspx |

**1. Resource Savings:**

**Improve Industrial Equipment Energy Efficiency:**

Commercial Electricity Energy Savings (kWh)=E × $Csf_{2020}$ × Ce x F

Commercial Natural Gas Savings (therms)=N × $Csf_{2020}$ × Cn

Commercial Electricity Energy Savings (kWh)=E × $Csf_{2030}$ × Ce x F

Commercial Natural Gas Savings (therms)=N × $Csf_{2030}$ × Cn

| | | |
|---|---|---|
| Total commercial electricity savings by 2020= | 22,404 | kwh/year |
| Total commercial natural gas savings by 2020= | 17,542 | therms /year |
| Total commercial electricity savings by 2030= | 31,408 | kwh/year |
| Total commercial natural gas savings by 2030= | 24,592 | therms /year |

**2. GHG Calculations:**

Total Emissions Savings (MT)= (Se/1000×Efa)+(Sg/10 × Efb/1000)

| | |
|---|---|
| Se = | total electricity savings (kWh) |
| Sg= | total natural gas savings (therms) |
| 1000 | = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) |
| 10 | = conversion factor for therm to MMBtu |

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 100 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 140 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet E 1.6

| | |
|---|---|
| **Strategy Name** | Shade Trees |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Projected Residential Electricity Use in 2020 | 10,485,353 | kwh/year | $Re_{2020}$ |
| Projected Residential Natural Gas Use in 2020 | 1,210,507 | therms/year | $Rg_{2020}$ |
| Number of Housing Units in 2020 | 2,550 | housing units | $H_{2020}$ |
| Number of Housing Units participating in program by 2020 [1] | 51 | housing units | $Hp_{2020}$ |
| Projected Commercial Electricity Use in 2020 | 1,697,298 | kwh/year | $Ce_{2020}$ |
| Projected Commercial Natural Gas Use in 2020 | 1,169,470 | therms/year | $Cg_{2020}$ |
| Number of Commercial Units in 2020 | 242 | comm. units | $C_{2020}$ |
| Number of Commercial Units participating in program by 2020 [2] | 2 | comm. units | $Cp_{2020}$ |
| 5% Reduction in energy use for residences (based on SMUD Calculator) | 95% | | 0.95 |
| Projected Residential Electricity Use in 2030 | 12,867,877 | kwh/year | $Re_{2030}$ |
| Projected Residential Natural Gas Use in 2030 | 1,485,563 | therms/year | $Rg_{2030}$ |
| Number of Housing Units in 2030 | 3,000 | housing units | $H_{2030}$ |
| Number of Housing Units participating in program by 2030 [3] | 60 | housing units | $HP_{2030}$ |
| Projected Commercial Electricity Use in 2030 | 2,039,477 | kwh/year | $Ce_{2030}$ |
| Projected Commercial Natural Gas Use in 2030 | 1,405,238 | therms/year | $Cg_{2030}$ |
| Number of Commercial Units in 2030 | 291 | comm. units | $C_{2020}$ |
| Number of Commercial Units participating in program by 2030 [4] | 3 | comm. units | $CP_{2030}$ |
| 10% Reduction in energy use for offices/retail (based on SMUD Calculator) | 90% | | 0.9 |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Natural Gas emission factor (kg CO2/MMBtu) | 53.02 | kg CO2/MMBtu | Efb |
| # of trees planted per year | 188 | trees/year | T |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

[1] Assumed 2 percent of all housing units
[2] Assumed 1 percent of all commercial units
[3] Assumed 2 percent of all housing units
[4] Assumed 1 percent of all commercial units

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| SMUD Shade Tree Benefit Calculator https://usage.smud.org/treebenefit/iDefault.aspx<br>"The simulations predicted annual total energy savings of about 3–5% from combined direct and indirect effects for old and new gas-heated single-family and rowhouse residences. This number increased to 10% for offices (SIC) and 12% for retail stores (sic)" |
| LBNL 2001 - Shade trees reduce building energy use and CO2 emissions from power plants<br>"We estimate that a tree planted in Los Angeles avoids the combustion of 18 kg of carbon per tree annually" |
| EPA http://www.epa.gov/heatisland/resources/pdf/toronto_energysavings.pdf |

**Voluntary Shade Tree Program:**

Electricity savings residential by 2020 = $Re_{2020}/H_{2020}$ x $HP_{2020}$ x 0.95 x F

Natural gas savings residential by 2020 = $Rg_{2020}/H_{2020}$ x $HP_{2020}$ x 0.95

Electricity savings commercial by 2020 = $Ce_{2020}/C_{2020}$ x $CP_{2020}$ x 0.95 x F

Natural gas savings commercial by 2020 = $Cg_{2020}/C_{2020}$ x $CP_{2020}$ x 0.95

Electricity savings residential by 2030 = $Re_{2030}/H_{2030}$ x $HP_{2030}$ x 0.90 x F

Natural gas savings residential by 2030 = $Rg_{2030}/H_{2030}$ x $HP_{2030}$ x 0.90

Electricity savings commercial by 2030 = $Ce_{2030}/C_{2030}$ x $CP_{2030}$ x 0.90 x F

Natural gas savings commercial by 2030 = $Cg_{2030}/C_{2030}$ x $CP_{2030}$ x 0.90

**1. Resource Savings:**

| | | | | | |
|---|---|---|---|---|---|
| Total residential electricity savings by 2020= | 175,315 | kwh/year | Total electricity savings by 2020= | 189,505 | kwh/year |
| Total residential natural gas savings by 2020= | 23,000 | therms/year | Total natural gas savings by 2020= | 34,110 | therms/year |
| Total commercial electricity savings by 2020= | 14,189 | kwh/year | | | |
| Total commercial natural gas savings by 2020= | 11,110 | therms/year | | | |
| Total residential electricity savings by 2030= | 203,827 | kwh/year | Total electricity savings by 2030= | 219,980 | kwh/year |
| Total residential natural gas savings by 2030= | 26,740 | therms/year | Total natural gas savings by 2030= | 39,387 | therms/year |
| Total commercial electricity savings by 2030= | 16,153 | kwh/year | | | |
| Total commercial natural gas savings by 2030= | 12,647 | therms/year | | | |

**2. GHG Calculations:**

Total Emissions Savings (MT)= (Se/1000×Efa)+(Sg/10 × Efb/1000) + [(T x 15)*0.001]

Se = total electricity savings (kWh)

Sg= total natural gas savings (therms)

1000 = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)

10 = conversion factor for therm to MMBtu

0.001 = conversion factor from kg to metric tons

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 242 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 280 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E 2.1

| | |
|---|---|
| **Strategy Name** | On-Site Renewable Energy for Homes |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Average solar installation size[1] | 4 | kW | P |
| Number of New Solar PV Systems by 2020[2] | 255 | systems | $S_{2020}$ |
| Number of New Solar PV Systems by 2030[3] | 600 | systems | $S_{2020}$ |
| Hours of daylight in a year (assume six hours of sunlight per day) | 1,380 | hrs/yr | H |
| Performance Ratio | 80% | | R |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

[1]California Solar Initiative Average Solar Installation Size: http://www.pge.com/includes/docs/pdfs/myhome/saveenergymoney/solarenergy/solar_consumer_guide.pdf (pg. 8)

[2]Assumed 10% of homes

[3]Assumed 20% of homes

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml |
| Solar capacity factor. http://en.wikipedia.org/wiki/Solar_power_in_California |

**1. Resource Savings:**

| **Promote Small-scale On-site Renewable Energy for Homes:** | | |
|---|---|---|
| Energy Savings (kWh): P x S x H x R x F | | |
| Total electricity savings by 2020= | 990,950 | kwh |
| Total commercial electricity savings by 2030= | 2,331,648 | kwh |

**2. GHG Calculations:**

| | | |
|---|---|---|
| Total Emissions Savings (MT)= (Se/1000×Efa) | | |
| Se = total electricity savings (kWh) | | |
| 1000 = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) | | |
| Total GHG Emissions Savings by 2020= | 307 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 721 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E 2.2

| | |
|---|---|
| **Strategy Name** | On-Site Renewable Energy for Commercial and Industrial Users |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Non-residential Space by 2020 | 640,500 | square ft | $NC_a$ |
| Non-residential Space by 2030 | 769,626 | square ft | $NC_b$ |
| Participation Rate in 2020 | 10% | | P |
| Participation Rate in 2030 | 20% | | P |
| % Total Electricity Savings by 2020 | 50% | percent | $S_a$ |
| % Total Electricity Savings by 2030 | 75% | percent | $S_b$ |
| Hughson electric use intensity factor for comm. buildings in kWh/sq ft. | 2.65 | kwh/square foot | N |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| New Oakdale development square footage projections: Oakdale General Plan Update 2012 |
| Projection of GHG Emissions for California Utilities: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/GHG_Emission_Factor_Guidance.pdf |
| Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml |
| |

**1. Resource Savings:**

**Promote On-site Renewable Energy for Commercial and Industrial Users:**
Energy Savings (kWh): Nca x P x S x N x F

| | | |
|---|---|---|
| Total electricity savings by 2020= | 74,681 | kwh |
| Total electricity savings by 2030= | 269,211 | kwh |

**2. GHG Calculations:**

Total Emissions Savings (MT)= (Se/1000×Efa)+(Sg/10 × Efb/1000)

| | |
|---|---|
| Se = | total electricity savings (kWh) |
| Sg= | total natural gas savings (therms) |
| 1000 = | conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) |
| 10 = | conversion factor for therm to MMBtu |

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 23 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 83 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E 2.3

| | |
|---|---|
| **Strategy Name** | Regional Renewable Energy Partnerships |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Average solar installation size | 0 | kW | P |
| Number of new solar systems by 2020 | 1 | systems | $S_{2020}$ |
| Number of new solar systems by 2030 | 2 | systems | $S_{2020}$ |
| Performance Ratio | 80% | | R |
| Hours of daylight in a year (assume six hours of sunlight per day) | 2,920 | hrs/yr | H |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml |
| Solar capacity factor. http://en.wikipedia.org/wiki/Solar_power_in_California |

**1. Resource Savings:**

| **Establish Regional Renewable Energy Partnerships:** | | |
|---|---|---|
| Energy Savings (kWh): S x P x R x E x H | | |
| Total electricity savings by 2020= | 0 | kwh |
| Total commercial electricity savings by 2030= | 0 | kwh |

**2. GHG Calculations:**

| | | |
|---|---|---|
| Total Emissions Savings (MT)= (Se/1000×0.13) | | |
| Se = total electricity savings (kWh) | | |
| 1000 = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) | | |
| 0.68 projected PG&E emission factor in 2020 | | |
| Total GHG Emissions Savings by 2020= | 0 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 0 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E 3.1

| | |
|---|---|
| **Strategy Name** | Increase Municipal Energy Efficiency |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Total square feet of upgraded municipal space from 2005 to 2020 | 111,241 | square ft | NCa |
| Total square feet of upgraded municipal space from 2005 to 2030 | 254,173 | square ft | NCb |
| % Electricity Savings (by 2020) | 15.0% | percent | Sb |
| Proportion of buildings that are assumed to be 15% more energy efficient than existing Title 24 | 3.0% | percent | B |
| Reduction in electricity and nat. gas usage for those buildings that achieve 15% more energy efficiency than existing Title 24 | 15.0% | percent | R |
| Hughson electric use intensity factor for comm. buildings in kWh/sq ft. | 2.65 | Metric Tons/MWh | Efa |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Natural Gas emission factor (kg CO2/MMBtu) | 53.02 | kg CO2/MMBtu | Efb |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| CALGreen Guidance: www.hcd.ca.gov/CALGreen.html |
| Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11- |
| Projection of GHG Emissions for California Utilities: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/GHG_Emission_Factor_Guidance.pdf |
| Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml |
| State of Indiana. Green Building cost estimates. https://bloomington.in.gov/green-building-costs |

**1. Resource Savings:**

**Increase Municipal Energy Efficiency:**

Total Electricity Savings by 2020 (kWh) = [(Nca × Sa × P) + (Nca x R x B)] x E

Total Natural Gas Savings by 2020 (therms)= [(Nca × Sa × P) + (Nca x R x B)] x N

Total Electricity Savings by 2030 (kWh) = [(Ncb × Sa × P) + (Ncb x R x B)] x E

Total Natural Gas Savings by 2030: (therms) = [(Ncb × Sa × P) + (Ncb x R x B)] x N

| | | |
|---|---|---|
| Total electricity savings by 2020= | 40,079 | kwh |
| Total electricity savings by 2030= | 91,575 | kwh |

**2. GHG Calculations:**

| | | |
|---|---|---|
| Total Emissions Savings (MT)= (Se/1000×Efa) | | |
| Se = total electricity savings (kWh) | | |
| Sg= total natural gas savings (therms) | | |
| 1000 = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) | | |
| 10 = conversion factor for therm to MMBtu | | |
| Total GHG Emissions Savings by 2020= | 12 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 28 | metric tons CO2 |

# Strategy GHG and Cost Analysis Worksheet: E 3.2

| | |
|---|---|
| **Strategy Name** | Increase Municipal Renewable Energy |
| **Emissions Category** | Energy |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Aggregate Solar Installation Size | 0 | kW | P |
| Hours of daylight in a year (assume six hours of sunlight per day) | 1,380 | hrs/yr | H |
| Performance Ratio | 80% | | R |
| Electricity emission factor (MT CO2/MWh) | 0.31 | Metric Tons/MWh | Efa |
| Renewable Portfolio Standard (RPS) Adjustment Factor | 0.88 | | F |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| New Oakdale development square footage projections: Oakdale General Plan Update 2012 |
| Projection of GHG Emissions for California Utilities: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/GHG_Emission_Factor_Guidance.pdf |
| Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml |

**1. Resource Savings:**

**Increase Municipal Renewable Energy:**
Electricity Savings (kWh): P x H x R x F

| | | |
|---|---|---|
| Total electricity savings by 2020= | 0 | kwh |
| Total electricity savings by 2030= | 0 | kwh |

**2. GHG Calculations:**

Total Emissions Savings (MT)= (Se/1000×Efa)+(Sg/10 × Efb/1000)

| | |
|---|---|
| Se = | total electricity savings (kWh) |
| Sg= | total natural gas savings (therms) |
| 1000 = | conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation) |
| 10 = | conversion factor for therm to MMBtu |

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | - | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | - | metric tons CO2 |

# City of Hughson Transportation and Land Use Strategies
# Summary Table

| Code | Strategy Name | GHG Reduction in 2020 | GHG Reduction in 2030 | Annual Cost to the City (low, medium, or high) |
|---|---|---|---|---|
| **1. Reduce Single-Occupancy Vehicle Travel** | | | | |
| Strategy T.1.1 | Local Commute Trip Reduction | 347 | 407 | Low |
| Strategy T.1.2 | Regional Transportation Management | N/A | N/A | Low |
| Strategy T.1.3 | Parking Reduction Policies | 44 | 50 | Low |
| **2. Increase Non-motorized Travel** | | | | |
| Strategy T.2.1 | Bicycle and Pedestrian Infrastructure Improvement | 15 | 17 | |
| Strategy T.2.2 | Safe Routes to Schools | 51 | 57 | |
| **3. Improve Public Transit and Increase Usage** | | | | |
| Strategy T.3.1 | Public Transit Expansion | 43 | 48 | Low |
| **4. Increase Motor Vehicle Efficiency** | | | | |
| Strategy T.4.1 | Fuel Efficient and Alternative Fuel Vehicle Use | 54 | 109 | Medium |
| Strategy T.4.2 | Fuel Efficiency for Municipal Fleet | 20 | 61 | High |
| **5. Promote Sustainable Growth Patterns** | | | | |
| Strategy LU.1.1 | Sustainable Growth Pattern | 760 | 856 | Low |
| **6. Support Locally-Produced Foods** | | | | |
| Strategy LU.2.1 | Farmer's Markets | N/A | N/A | Low |
| | **Totals:** | 1,333 | 1,604 | |

# Transportation: Common Factors

Factors with a pale yellow background color are not subject to change for Hughson. Factors with a pale green background color are subject to modification, based on the implementation depth of the particular reduction strategy.

| | # | Unit |
|---|---|---|
| **Basic Unit Factors** | | |
| Hours in a year | 8,760 | hrs/yr |
| Elasticity of VMT with respect to density (from: Boarnet and Handy, 2010) | 0.07 | |
| Stanislaus County Annual Tons CO2/day (EMFAC 2011) for 2020 | 9,072.42 | Tons CO2/day |
| Stanislaus County Annual VMT/day (EMFAC 2011) for 2020 | 14,219,793 | VMT/day |
| Stanislaus County Annual Tons CO2/day (EMFAC 2011) for 2030 | 10,333.67 | Tons CO2/day |
| Stanislaus County Annual VMT/day (EMFAC 2011) for 2030 | 16,014,540.00 | VMT/day |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.000638014 | MT CO2/VMT |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.000645268 | MT CO2/VMT |
| Metric Tons per Short Ton | 0.91 | MT/Ton |
| **VMT** | | |
| Total Annual VMT in 2005 | 49,065,800 | VMT/year |
| Total Annual VMT in 2020 | 59,908,448 | VMT/year |
| Total Annual VMT in 2030 | 66,755,588 | VMT/year |
| Total Commute VMT in 2005 | 13,591,227 | VMT/year |
| Total Commute VMT in 2020 | 16,594,640 | VMT/year |
| Total Commute VMT in 2030 | 18,491,298 | VMT/year |
| Total Highway VMT in 2005 | 22,889,196 | VMT/year |
| Total Highway VMT in 2020 | 27,947,291 | VMT/year |
| Total Highway VMT in 2030 | 31,141,482 | VMT/year |
| **GHG Emission Factors** | | |
| TID Electricity emission factor (lbs/kWh) | 0.6820 | lbs $CO_2$/kWh |
| TID Electricity emission factor (lbs/MWh) | 0.0290 | lbs $CH_4$/MWh |
| TID Electricity emission factor (lbs/MWh) | 0.0110 | lbs $N_2O$/MWh |
| Natural Gas emission factor (kg/MMBtu) | 53.0200 | kg CO2/MMBtu |
| Natural Gas emission factor (kg/MMBtu) | 0.0050 | kg CH4/MMBTU |
| Natural Gas emission factor (kg/MMBtu) | 0.0001 | kg N2O/MMBTu |
| **Projected City Growth Factors** | | |
| City Square Mileage | 1.82 | sq. mile |
| City Sphere-of-Influence (SOI) Square Mileage | 1.9 | sq. mile |
| City Acres in 2005 | 1,162 | Acres |
| City Acres in 2020 | 1,162 | Acres |
| City Acres in 2030 | 2,378 | Acres |
| Total # of housing units in 2005 | 1,915 | Housing Units |
| Total # of housing units in 2020 | 2,383 | Housing Units |
| Total # of housing units in 2030 | 2,643 | Housing Units |
| Housing Units per Acre in 2005 | 1.65 | units per acre |
| Housing Units per Acre in 2020 | 2.05 | units per acre |
| Housing Units per Acre in 2030 | 1.11 | units per acre |
| 2005 Residential Square Feet | 2,772,920 | square ft |
| 2020 Residential Square Feet | 3,737,468 | square ft |
| 2030 Residential Square Feet | 4,273,328 | square ft |
| **Cost Factors** | | |
| BLS U.S. Department of Labor: Average Stanislaus County Salary | $ 20.22 | $ |
| BLS U.S. Department of Labor: Average Stanislaus County Hourly Rate | $ 40,768.00 | $ |

# GHG and Cost Analysis Worksheet: T.1.1

| | |
|---|---|
| **Strategy Name** | **Implement Voluntary Commute Trip Reduction Program** |
| **Emissions Category** | Transportation and Land Use |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| **I. Telecommuting** | | | |
| Expected % of Job-workers Participating [1] | 2% | % | |
| Work Week Choice | 4-day/40 hr | | |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.000638 | MT CO2/VMT | $Cef_{2020}$ |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.000645 | MT CO2/VMT | $Cef_{2030}$ |
| Commute VMT in 2020 | 16,594,640 | VMT/year | $V_{2020}$ |
| Commute VMT in 2030 | 18,491,298 | VMT/year | $V_{2030}$ |
| **II. Carpool Program** | | | |
| Total Number of Program Recipients in 2020 | 744 | | R |
| Total Number of Program Recipients in 2030 | 829 | | R |
| Percent Participation | 10% | | |
| Average Daily Commute VMT per Person [2] | 36.1 | | D |
| Working Days Per Year | 260 | | W |
| Average Vehicle Occupancy in Carpool Vehicles | 2.5 | | A |

[1] Based on a 10% particpation goal of eTrip, and 60% of all employees are at companies subject to eTrip and City requirements; SJVAPCD Final Staff Report, Rule 9140 (Employer Based Trip Reduction) December 17, 2009.

[2] Based on the 2011 Average Stanislaus County One-way Commute time to work of 27.1 minutes (See: http://www.dot.ca.gov/hq/tpp//offices/eab/socio_economic_files/2011/Stanislaus.pdf). Also assumes an average of 40 mph for the length of the commute.

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| CAPCOA *Quantifying Greenhouse Gas Mitigation Measures* (Measure TRT-6). Note: Measure calculations based on data in Fehr & Peers, *Moving Cooler Technical Appendices*. |
| EMFAC 2011 model run, Mendocino County. |
| *SJVAPCD Final Staff Report* , Rule 9140 (Employer Based Trip Reduction) December 17, 2009. |
| SEEC Community Inventory Tool, Reduction Measure: Transportation - Carpooling. Available at: https://c.na5.visual.force.com/apex/ForecastMeasure |

**1. Resource Savings:**

**I: Telecommuting**

| | | VMT Reduction = VMT x % Reduction in Commute VMT<br>See table below (Source: CAPCOA, TRT-6) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Employee Participation | | | | | |
| | | 1% | 3% | 5% | 10% | 25% | |
| | | % Reduction in Commute VMT | | | | | |
| Work week | 9-day/80 hr | *0.07%* | *0.21%* | *0.35%* | *0.70%* | *1.75%* | |
| | 4-day/40 hr | *0.15%* | *0.45%* | *0.75%* | *1.50%* | *3.75%* | |
| | telecommuting 1.5 days | *0.22%* | *0.66%* | *1.10%* | *2.20%* | *5.50%* | |

| | | |
|---|---|---|
| VMT Reduction by 2020= | 124,460 | VMT |
| VMT Reduction by 2030= | 138,685 | VMT |

**II: Carpool**

| Commute:<br>VMT Reduction = R x P x D x W x A<br>(Source: SEEC Reduction Measure Tool) | | |
|---|---|---|
| VMT Reduction by 2020= | 419,209 | VMT |
| VMT Reduction by 2030= | 499,063 | VMT |

**2. GHG Calculations:**

| Total Emissions Savings (MT)= VMT Reduction x Cef | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 347 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 407 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: T.1.2

| Strategy Name | Support Regional Transportation Management |
|---|---|
| Emissions Category | Transportation and Land Use |

No Quantification.

# GHG and Cost Analysis Worksheet: T.1.3

| | |
|---|---|
| **Strategy Name** | **Develop Parking Reduction Policies** |
| **Emissions Category** | Transportation and Land Use |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Commute VMT in 2020 | 16,594,640 | VMT/year | $V_{2020}$ |
| Commute VMT in 2030 | 18,491,298 | VMT/year | $V_{2030}$ |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.0006380 | MT CO2/VMT | $Cef_{2020}$ |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.0006453 | MT CO2/VMT | $Cef_{2030}$ |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| EMFAC 2007 model run, April 22 2011. (Conditions: all vehicle types, 70 degree F, 50% humidity, calendar year 2011, San Mateo County) |
| CAPCOA Quantifying Greenhouse Gas Mitigation Measures (Measure SDT-3). Note: Measure calculations based on data in Fehr & Peers, Moving Cooler Technical Appendices. |

**1. Resource Savings:**

| **VMT Reduction = VMT x 0.0042 (See CAPCOA SDT-3)** | | |
|---|---|---|
| VMT Reduction by 2020= | 69,697 | VMT |
| VMT Reduction by 2030= | 77,663 | VMT |

**2. GHG Calculations:**

| Total Emissions Savings (MT)= VMT Reduction x Cef | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 44 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 50 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: T.2.1

| | |
|---|---|
| **Strategy Name** | Improve Bicycle and Pedestrian Infrastructure |
| **Emissions Category** | Transportation and Land Use |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Commute VMT in 2020 | 16,594,640 | VMT/year | $V_{2020}$ |
| Commute VMT in 2030 | 18,491,298 | VMT/year | $V_{2030}$ |
| Miles of Bike Lanes Added | 8 | | |
| Composite Emission Factor; MT CO2 per VMT (EMFAC 2007) | 0.000638 | MT CO2/VMT | Cef |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| CAPCOA Quantifying Greenhouse Gas Mitigation Measures (Measure TRT-4 and SDT-6). |
| EMFAC 2011 model run, Mendocino County. |

**1. Resource Savings:**

**Bike Lane Expansion:**
**VMT Reduction =**
**For 2 miles of added bike lane: 0.05% GHG reduction**
**For 4 miles of added bike lane: 0.09 GHG reduction**
**For 8 miles of added bike lane: 0.14% GHG reduction**
**(See CAPCOA SDT-6)**

**Assume maximum number of bike lanes added, yielding 0.14% VMT Reduction.**

| | | |
|---|---|---|
| VMT Reduction by 2020= | 23,232 | VMT |
| VMT Reduction by 2030= | 25,888 | VMT |

**2. GHG Calculations:**

Total Emissions Savings (MT)= VMT Reduction x Cef

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 15 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 17 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: T.2.2

| | |
|---|---|
| **Strategy Name** | Build and Improve Safe Routes to Schools |
| **Emissions Category** | Transportation and Land Use |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Total VMT in 2020 minus Highway VMT in 2020 | 31,961,157 | VMT/year | $V_{2020}$ |
| Total VMT in 2020 minus Highway VMT in 2030 | 35,614,106 | VMT/year | $V_{2030}$ |
| % of intersections w/ New Improvements | 25% | % | See Table |
| % of Streets w/ New Improvements | 25% | % | See Table |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.000638 | MT CO2/VMT | $Cef_{2020}$ |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.000645 | MT CO2/VMT | $Cef_{2030}$ |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| CAPCOA Quantifying Greenhouse Gas Mitigation Measures (Measure SDT-2). |
| EMFAC 2011 model run, Mendocino County. |

**1. Resource Savings:**

| | | Street Improvements: VMT Reduction = VMT x % Reduction in VMT (see CAPCOA SDT-2) | | | |
|---|---|---|---|---|---|
| | | % of Streets w/ Improvements | | | |
| | | 25% | 50% | 75% | 100% |
| | | % Reduction in Commute VMT | | | |
| % of intersections w/ improvements | 25% | 0.25% | 0.25% | 0.50% | 0.50% |
| | 50% | 0.25% | 0.50% | 0.50% | 0.75% |
| | 75% | 0.50% | 0.50% | 0.75% | 0.75% |
| | 100% | 0.50% | 0.75% | 0.75% | 1.00% |

| | | |
|---|---|---|
| VMT Reduction by 2020= | 79,903 | VMT |
| VMT Reduction by 2030= | 89,035 | VMT |

**2. GHG Calculations:**

| Total Emissions Savings (MT)= VMT Reduction x Cef | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 51 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 57 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: T.3.1

| | |
|---|---|
| **Strategy Name** | Improve Public Transit Use |
| **Emissions Category** | Transportation and Land Use |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Annual VMT in 2020 | 59,908,448 | VMT/year | $V_{2020}$ |
| Annual VMT in 2030 | 66,755,588 | VMT/year | $V_{2030}$ |
| Public Transit Network Coverage Expansion | 0.0% | % | Coverage |
| Elasticity (1.01 for suburban settings) | 1.01 | | B |
| Existing Public Transporatation Mode Share[1] | 1.3% | % | Mode |
| Adjustments to transit ridership increase to VMT (typically 0.67) | 0.67 | | D |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.000638 | MT CO2/VMT | Cef |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.000645 | MT CO2/VMT | Cef |
| % Reduction in Headway (reasonable range from 15-80%) | 15.0% | % | Headway |
| elasticity of transit ridership w/ respect to increased service freq. (0.36 in suburban settings) | 0.36 | | B |
| Frequency/speed component: adjustment for level of implementation = number of lines improved / total number of lines serving project where:<br><50% = 50% adjustment<br>>=50% = 85% adjustment | 85% | % | C |

[1] 1.3% is typical for suburban developments

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| CAPCOA Quantifying Greenhouse Gas Mitigation Measures (Measure TST-3 and TST-4). |
| EMFAC 2011 model run, Mendocino County. |

**1. Resource Savings:**

| | | |
|---|---|---|
| **Expanding Transit Network:**<br>**VMT Reduction = VMT x (Coverage * B * Mode * D)**<br>**(see CAPCOA TST-3)** | | |
| VMT Reduction by 2020 (from expanding transit network)= | 0 | VMT |
| VMT Reduction by 2030 (from expanding transit network)= | 0 | VMT |
| **Increasing Transit Frequency/Speed**<br>**VMT Reduction = VMT x (Headway * B * C * Mode * D)**<br>**(see CAPCOA TST-4)** | | |
| VMT Reduction by 2020 (from expanding transit network)= | 67,195 | VMT |
| VMT Reduction by 2030 (from expanding transit network)= | 74,875 | VMT |

**2. GHG Calculations:**

| | | |
|---|---|---|
| Total Emissions Savings (MT)= VMT Reduction x Cef | | |
| Total GHG Emissions Savings by 2020= | 43 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 48 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: Strategy T.4.1

| | |
|---|---|
| **Strategy Name** | Increase Motor Vehicle Efficiency |
| **Emissions Category** | Transportation and Land Use |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Degree of Implementation (# of vehicles replaced w/ an electric powered model) by 2020 | 10 | | $D_a$ |
| Degree of Implementation (# of vehicles replaced w/ an electric powered model) by 2030 | 20 | | $D_b$ |
| Average Annual VMT per vehicle | 12,000 | | A |
| Existing Fuel Economy | 20.3 | | E |
| Expected New Electric Vehicle Average Fuel Economy | 100 | | F |
| RPS Adjustment Factor | 88.0% | | R |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.000638 | MT CO2/VMT | Cef |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.000645 | MT CO2/VMT | Cef |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| SEEC Community Inventory Tool, Reduction Measure: Transportation - Provide Electric Vehicle Charging. Available at: https://c.na5.visual.force.com/apex/ForecastMeasure |
| EMFAC 2011 model run, Mendocino County. |

**1. Resource Savings:**

| **Increase Motor Vehicle Efficiency Program:**<br>**VMT Reduction = D x A x (1-(E/F)) x R** | | |
|---|---|---|
| VMT Reduction by 2020= | 84,163 | VMT |
| VMT Reduction by 2030= | 168,326 | VMT |

**2. GHG Calculations:**

| Total Emissions Savings (MT)= VMT Reduction x Cef | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 54 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 109 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: Strategy T.4.2

| | |
|---|---|
| **Strategy Name** | Improve Fuel Efficiency for Municipal Fleet |
| **Emissions Category** | Transportation and Land Use |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Degree of Implementation (# of City vehicles replaced w/ an electric powered model) by 2020 | 5 | | $D_a$ |
| Degree of Implementation (# of vehicles replaced w/ an electric powered model) by 2030 | 15 | | $D_b$ |
| Average Annual VMT per vehicle | 12,000 | | A |
| Existing Fuel Economy | 20.3 | | E |
| Expected Average New Alternative/Hybrid Vehicle Fuel Economy | 50 | | F |
| RPS Adjustment Factor | 88.0% | | R |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.000638 | MT CO2/VMT | Cef |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.000645 | MT CO2/VMT | Cef |

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| SEEC Community Inventory Tool, Reduction Measure: Transportation - Hybrid Vehicles. Available at: https://c.na5.visual.force.com/apex/ForecastMeasure |
| EMFAC 2011 model run, Mendocino County. |

**1. Resource Savings:**

| **Improve Fuel Efficiency for Municipal Fleet:**<br>**VMT Reduction = D x A x (1-(E/F)) x R** | | |
|---|---|---|
| VMT Reduction by 2020= | 31,363 | VMT |
| VMT Reduction by 2030= | 94,090 | VMT |

**2. GHG Calculations:**

| Total Emissions Savings (MT)= VMT Reduction x Cef | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 20 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 61 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: LU.1.1 (part I)

**Note: This calculation calculates ghg emissions savings from increasing density. Density is expected to increase from 1.65 housing units per acre to 2.05 units/acre in 2020 and 2.28 units/acre in 2030. This will increase destination accessibility and reduce automobile dependency.**

| | |
|---|---|
| **Strategy Name** | Encourage Higher Density and Mixed Use Growth Patterns |
| **Emissions Category** | Transportation and Land Use |

**Key Assumptions for Resource Savings and GHG Calculations**

| Description | # | Unit | Equation Variable |
|---|---|---|---|
| VMT in 2020 | 59,908,448 | VMT/year | $V_{2020}$ |
| VMT in 2030 | 66,755,588 | VMT/year | $V_{2030}$ |
| % Increase units/acre by 2020 | 24% | units/acre | A |
| % Increase units/acre by 2030 | 24% | units/acre | A |
| Elasticity of VMT with respect to density (from: Boarnet and Handy 2010) | 0.07 | | EVMTd |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.000638 | MT CO2/VMT | Cef |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.000645 | MT CO2/VMT | Cef |

Assume no increase after 2020 for conservative purposes.

**Data Sources for Resource Savings and GHG Calculations**

CAPCOA Quantifying Greenhouse Gas Mitigation Measures (Measure LUT-1).

EMFAC 2011 model run, Stanislaus County.

Nelson\Nygaard, 2005. Crediting Low-Traffic Developments (p.12). Journal of the American Planning Association:

Boarnet, Marlon and Handy, Susan. 2010. "Draft Policy Brief on the Impacts of Residential Density Based on a Review of Empirical Literature."

Criteron Planner/Engineers and Fehr & Peers Associates (2001). Index 4D Method. A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes. Technical Memorandum prepared for US EPA, October 2001.

**1. Resource Savings:**

**Increase Density:**
**VMT Reduction = VMT × (A × EVMTd)**

| | | |
|---|---|---|
| VMT Reduction by 2020= | 1,024,857 | VMT |
| VMT Reduction by 2030= | 1,141,991 | VMT |

**2. GHG Calculations:**

Total Emissions Savings (MT)= VMT Reduction x Cef

| | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 654 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 737 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: LU.1.1 (part II)

Note: This calculation takes into account increases in local employment due to increases in mixed-use developments in Hughson.

| | |
|---|---|
| **Strategy Name** | Encourage Higher Density and Mixed Use Growth Patterns |
| **Emissions Category** | Transportation and Land Use |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Increase in local employment as a result of incentives, by 2020[1] | 1% | | $I_a$ |
| Increase in local employment as a result of incentives, by 2030[1] | 1% | | $I_b$ |
| Total Commute VMT in 2020 | 16,594,640 | VMT/year | $V_a$ |
| Total Commute VMT in 2030 | 18,491,298 | VMT/year | $V_b$ |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020 | 0.000638 | MT CO2/VMT | Cef |
| Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030 | 0.000645 | MT CO2/VMT | Cef |

[1]Assumes increase in mixed-use commercial (e.g. retail) will partially negate the need for commuting for the proportion of residents that live locally (since they no longer need to commute to other cities for work).

| **Data Sources for Resource Savings and GHG Calculations** |
|---|
| CAPCOA, Quantifying Greenhouse Gas Mitigation Measures (2010): |
| EMFAC 2007 model run, April 22 2011. (Conditions: all vehicle types, 70 degree F, 50% humidity, calendar year 2011, San Mateo County) |
| Nelson\Nygaard, 2005. Crediting Low-Traffic Developments (p.12). Journal of the American Planning Association: |
| Boarnet, Marlon and Handy, Susan. 2010. "Draft Policy Brief on the Impacts of Residential Density Based on a Review of Empirical Literature." |
| Criteron Planner/Engineers and Fehr & Peers Associates (2001). Index 4D Method. A Quick-Response Method of Estimating Travel Impacts from Land-Use Changes. Technical Memorandum prepared for US EPA, October 2001. |

**1. Resource Savings:**

| **Increase Local Employment Through Mixed Use Development:**<br>**VMT Reduction = I x V** | | |
|---|---|---|
| VMT Reduction by 2020= | 165,946 | VMT |
| VMT Reduction by 2030= | 184,913 | VMT |

**2. GHG Calculations:**

| Total Emissions Savings (MT)= VMT Reduction x Cef | | |
|---|---|---|
| Total GHG Emissions Savings by 2020= | 106 | metric tons CO2 |
| Total GHG Emissions Savings by 2030= | 119 | metric tons CO2 |

# GHG and Cost Analysis Worksheet: LU.2.1

| | |
|---|---|
| **Strategy Name** | Promote Sustainable Growth Patterns |
| **Emissions Category** | Transportation and Land Use |

No quantification.

# City of Hughson Solid Waste Strategies
# Summary Table

| | | CO2 (MT) | |
|---|---|---|---|
| **Code** | **Strategy Name** | **GHG Reduction by 2020** | **GHG Reduction by 2030** |
| **Goal SW.1: Reduce Community Solid Waste Sent to Landfill** | | | |
| Strategy SW.1.1 | Reduced Total Community Waste Tonnage Sent to Landfill by 20% | 86 | 143 |
| **Goal SW.2: Reduce Municipal Operations Solid Waste Sent to Landfill** | | | |
| Strategy SW.2.1 | Reduced Total Municipal Operations Waste Tonnage Sent to Landfill by 20% | 10 | 15 |
| | **Totals:** | **96** | **158** |

# Strategy GHG and Cost Analysis Worksheet: SW.1.1

| | |
|---|---|
| **Strategy Name** | Reduce Total Community Waste Tonnage Sent to Landfill by 25% |
| **Emissions Category** | Solid Waste |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Total GHG Emissions (MT CO2e) of Community Waste Generation in 2020 | 344.4 | MT CO2e | $T_{2020}$ |
| Hughson Population in 2020 | 7,437 | Population | $P_{2020}$ |
| MT CO2e Generated per Person (from Community Waste) in 2020 | 0.046 | MT CO2e | $M_{2020}$ |
| Total GHG Emissions (MT CO2e) of Community Waste Generation in 2030 | 408.8 | MT CO2e | $T_{2030}$ |
| Hughson Population in 2030 | 8,287 | Population | $P_{2030}$ |
| MT CO2e Generated per Person (from Community Waste) in 2030 | 0.049 | MT CO2e | $M_{2030}$ |
| Percent Reduction in Per Capita Community Waste Sent to Landfill in 2020 | 25% | % | $Z_{2020}$ |
| Percent Reduction in Per Capita Community Waste Sent to Landfill in 2030 | 35% | % | $Z_{2030}$ |

**2. GHG Savings:**

**Reduce Total Community Waste Sent to Landfill:**

Total Solid Waste Savings (tons) = M x P x Z

| | | |
|---|---|---|
| Total Solid Waste Savings by 2020 = | 86 | tons |
| Total Solid Waste Savings by 2030 = | 143 | tons |

# Strategy GHG and Cost Analysis Worksheet: SW.1.2

| | |
|---|---|
| **Strategy Name** | Reduce Municipal Operations Solid Waste Sent to Landfill by 25% |
| **Emissions Category** | Solid Waste |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Total GHG Emissions (MT CO2e) of Mun. Ops Waste Generation in 2020 | 38.4 | MT CO2e | $T_{2020}$ |
| Hughson Population in 2020 | 7,437 | Population | $P_{2020}$ |
| MT CO2e Generated per Person (from Mun. Ops Waste) in 2020 | 0.005 | MT CO2e | $M_{2020}$ |
| Total GHG Emissions (MT CO2e) of Mun. Ops Waste Generation in 2030 | 43.1 | MT CO2e | $T_{2030}$ |
| Hughson Population in 2030 | 8,287 | Population | $P_{2030}$ |
| MT CO2e Generated per Person (from Mun. Ops) in 2030 | 0.005 | MT CO2e | $M_{2030}$ |
| Percent Reduction in Per Capita Mun. Ops Waste Sent to Landfill in 2020 | 25% | % | $Z_{2020}$ |
| Percent Reduction in Per Capita Mun. Ops Waste Sent to Landfill in 2030 | 35% | % | $Z_{2030}$ |

**2. GHG Savings:**

**Reduce Total Community Waste Sent to Landfill:**

Total Solid Waste Savings (tons) = M x P x Z

| | | |
|---|---|---|
| Total Solid Waste Savings by 2020 = | 10 | tons |
| Total Solid Waste Savings by 2030 = | 15 | tons |

# City of Hughson: Water Strategies
# Summary Table

| | | CO2 (MT) | |
|---|---|---|---|
| **Code** | **Strategy Name** | **GHG Reduction by 2020** | **GHG Reduction by 2030** |
| **Goal W.1: Increase Community Water Conservation** | | | |
| Strategy W.1.1 | Reduce Community Water Consumption by 20%. | 89 | 89 |
| **Goal W.2: Reduce Municipal Operations Water Consumption by 20%** | | | |
| Strategy W.2.1 | Reduce Municipal Operations Water Consumption by 20%. | - | - |
| | **Totals:** | **89** | **89** |

# Strategy GHG and Cost Analysis Worksheet: W.1.1

| | |
|---|---|
| **Strategy Name** | Reduce Community Water Consumption by 20% |
| **Emissions Category** | Water |

| **Key Assumptions for Resource Savings and GHG Calculations** | | | |
|---|---|---|---|
| **Description** | **#** | **Unit** | **Equation Variable** |
| Total GHG Emissions (MT CO2e) of Water in 2005 | 443.2 | MT CO2e | T |
| Percent Reduction in Water Consumption 2020 | 20% | % | Z |
| Percent Reduction in Water Consumption 2030 | 20% | % | Z |

**1. GHG Savings:**

| **Reduce Community Water Consumption:** Total GHG Savings = T x Z | | |
|---|---|---|
| Total GHG Savings by 2020 = | 89 | MT |
| Total GHG Savings by 2030 = | 89 | MT |

# Strategy GHG and Cost Analysis Worksheet: W.2.1

City of Hughson: Water Strategies

| | |
|---|---|
| **Strategy Name** | Reduce Municipal Operations Water Consumption by 20% |
| **Emissions Category** | Water |

No quantification.